Cederberg vegetation and flora

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by

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STRELITZIA

This is the third occasional publication of the National Botanical Institute to appear under the series name *Strelitzia*. The new series has replaced *Memoirs of the Botanical Survey of South Africa* and *Annals of Kirstenbosch Botanic Gardens* which the NBI inherited from its predecessor organizations.

The genus *Strelitzia* occurs naturally in eastern southern Africa. It comprises three arborescent species, known as wild bananas, and two acaulescent species, known as crane flowers or bird-of-paradise flowers. The logo of the National Botanical Institute is based on the striking inflorescence of *Strelitzia reginae*, a native of the Eastern Cape and KwaZulu-Natal that has become a garden favourite worldwide. It symbolizes the commitment of the National Botanical Institute to provide the facilities, knowledge and expertise necessary to ensure the conservation, sustained use, appreciation and enjoyment of South Africa's exceptionally rich flora and vegetation.

Cover: The northern Cederberg (Groenberg 181) looking east toward the Tanqua Karoo, 1986-03-05.

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Contents

Clanwilliam cedar, *Widdringtonia cedarbergensis* about 8 m tall, growing on typical 'rock turrets' in the Welbedacht area.

Abstract

As an introduction to a study of the vegetation of the Cederberg, an important catchment in the drier northern part of the Western Cape, the geology, physiography, soils, climate, land use, biota and historical background are described. The discussion provides a broad contextual and environmental framework for the subsequent vegetation classification.

In the vegetation study of the northern Cederberg, the Braun-Blanquet method of sampling and analysis revealed 26 plant communities in two major structural and chorological units, thicket and fynbos. Thicket occurs on sites that provide natural protection from fire; fynbos is found in fire-prone habitats. Soil drainage appears to be the fundamental factor separating fynbos on well-drained slopes from fynbos on level sites with impeded drainage. Further subdivisions correlated with soil origin, depth, rockiness and altitude show that the floristic hierarchy is well correlated with environmental factors. Standard descriptions of each community provide a synopsis of vegetation structure and floristics, environmental influences and special features. The relationships between vegetation and habitat are illustrated by diagrams, photographs and a phytosociological table.

Floristic analysis, and comparison with two mountain floras in the southwestern Cape (Cape Hangklip area and Cape of Good Hope Nature Reserve), reveal that the Cederberg flora has links not only with the fynbos of the Cape Floristic Region but also with the dry winter rain shrubland of Namaqualand and the western Karoo. The checklist of the vascular plants in the Cederberg Wilderness and Mountain Catchment Area, records a total of 1 778 species.

Uittreksel

As inleiding tot 'n studie van die plantegroei van die Cederberg, 'n belangrike opvanggebied in die droër noordelike deel van die Wes-Kaap, word die geologie, fisiografie, gronde, klimaat, bodembenutting, biota en geskiedkundige agtergrond beskryf. Hierdie bespreking verskaf 'n breë kontekstuele en omgewingsraamwerk vir die daaropvolgende plantegroeiklassifikasie.

Deur toepassing van die Braun-Blanquet-tegniek op die plantegroei van die noordelike Cederberg, word 'n totaal van 26 plantgemeenskappe in twee hoofstrukturele en -chorologiese eenhede erken: ruigte en fynbos. Ruigte kom voor op plekke wat natuurlike beskerming teen brand bied, terwyl fynbos op plekke gevind word wat aan brand blootgestel is. Die fynbosplantgemeenskappe word eerstens op grond van gronddreinering verdeel in fynbos teen goedgedreineerde hellings en dié op gelyktes met belemmerde dreinering. Verdere onderverdelings toon dat die floristiese hiërargie goed gekorreleer is met omgewingsfaktore soos grondoorsprong en -diepte, rotsagtigheid en hoogte bo seevlak.

Standaardbeskrywings van elke plantgemeenskap verskaf 'n oorsig van plantegroeistruktuur en floristiese eienskappe, omgewingsinvloede en spesiale kenmerke. Die verhoudings tussen plantegroei en habitat word deur middel van diagramme, foto's en 'n fitososiologiese tabel geïllustreer.

Die floristiese analise en vergelyking met twee bergfloras in die Suidwes-Kaap (Kaap Hangklip-gebied en Kaap die Goeie Hoop Natuurreservaat) toon dat die Cederbergflora nie net met die fynbos van die Kaapse Floristiese Streek skakel nie, maar ook met die droë winterreënstruikveld van Namakwaland en die westelike karoo. 'n Totaal van 1 778 spesies vaatplante wat in die Cederberg-wildernis- en bergopvanggebied voorkom, word gelys.

1. Introduction

The Cederberg* lies east of the towns of Clanwilliam and Citrusdal in the Olifants River valley, between latitudes 32°00' and 32°45' south and longitudes 18°50' and 19°25' east. The range is about 90 km long and 25 km wide at its widest point near the middle. It is traversed by three roads: the main road from Clanwilliam over Pakhuis Pass in the north, a secondary road from Clanwilliam to Ceres in the central part, and the main road between Citrusdal and Ceres which crosses a narrow sector in the southern part.

Most of the vegetation is mountain fynbos but Karoo elements penetrate the deep valleys of the tributaries of the Doring River on the east side and, on the west, a karroid zone extends southward from Clanwilliam into the valleys of the Jan Dissels and Rondegat Rivers.

The mountain fynbos of the Capensis Region (Taylor 1978; Kruger 1979a), the Cape Floristic Region (Kruger 1979b) or the Fynbos Biome (Campbell 1985), with its exceptionally rich flora and high degree of endemism (Hall 1981), is in urgent need of carefully planned conservation management and development. The Cape floral kingdom is home to many useful herbs and medicinal plants, and its showy components, especially the Proteaceae, are the mainstay of an important wildflower industry (Davis 1990). Man's impact on this rich and diverse flora has been severe. Only 39% of its former area remains and fynbos now has the highest concentration of threatened plants of any temperate region (Hall 1980; Hilton-Taylor in press). Introduced woody plants have invaded and displaced the wild vegetation on a large scale (Taylor 1969; Hall & Boucher 1977). The conservation of mountain fynbos is therefore of high priority, not only on account of its water- and soil-holding capacity but also for its scientific importance, aesthetic appeal, recreational value and economic potential. But sound conservation must be based on informed management, and the first step in informing managers is to provide a framework of community data obtained from phytosociological surveys (Taylor 1962, 1963). The phytosociologist, in analysing, describing and classifying plant communities, creates the hierarchy of vegetation units and indicates the relationship of these units to one another and to their habitats. The experimental researcher and autecologist must subsequently provide an understanding of the dynamic processes involved, and from these derive management principles appropriate to each unit.

Accordingly, proposals for a semi-detailed phytosociological survey of selected mountain catchments were made (Taylor 1980, 1981) and adopted by the Forestry authorities. Campbell (1983, 1985, 1986a & b) has produced a primary survey of mountain fynbos for the whole Fynbos Biome using a classification based mainly on structural attributes of the vegetation. Campbell's important work will be discussed in Chapter 3. However, as a foundation for detailed resource assessment studies (Müller 1983) there remains a need for more detailed surveys which will provide an inventory of all species within each plant community. A trial of survey methods in the Cape of Good Hope Nature Reserve in 1969 (Taylor 1984a & b) led to the adoption of a floristic method based on the Zürich-Montpellier approach described by Mueller-Dombois & Ellenberg (1974) and Werger (1974).

Plant community studies in mountain fynbos have hitherto been concentrated in the south-western, southern and eastern parts of the Capensis Region, e.g.Bond (1981), Cowling (1984), Van Wilgen & Kruger (1985) and Boucher (1988). The northwestern extension of Acocks's (1988) Veld Type 69—Fynbos—has been largely neglected despite the presence of three major State Forests—Hawequas, Groot Winterhoek and Cederberg—and their adjoining mountain catchments. Surveys of Swartboschkloof (McDonald 1988) and in the Langeberg (McDonald 1993a, b & c) have been completed.

The veld types survey of South Africa by Acocks (1988), based on land potential, provided the first significant classification of vegetation for land use planning in this country on a broad landscape scale. For detailed planning and management within veld types, more precise methods have been adopted.

The Cederberg is the home of several rare, endemic or commercially exploitable plants. The endemic Clanwilliam cedar, *Widdringtonia cedarbergensis,* has been felled for sawtimber for over two centuries (Smith 1955), but studies on the effect of this exploitation and on the autecology of the species only began during this decade (Manders 1985). The mountain range forms the catchment of two rivers that irrigate arid lands both to east and west. By nature of its wild, spectacular scenery it has great potential recreational value (Ackerman 1972, 1979), and because it lies close to the northern boundary of the Cape Floristic Region its vegetation is of special scientific interest. The Ceder-

* The spelling 'Cederberg' was approved on 3rd April, 1981, by the (then) Minister of National Education (now Minister of Arts, Culture, Science and Technology) on the recommendation of the National Place Names Commission.

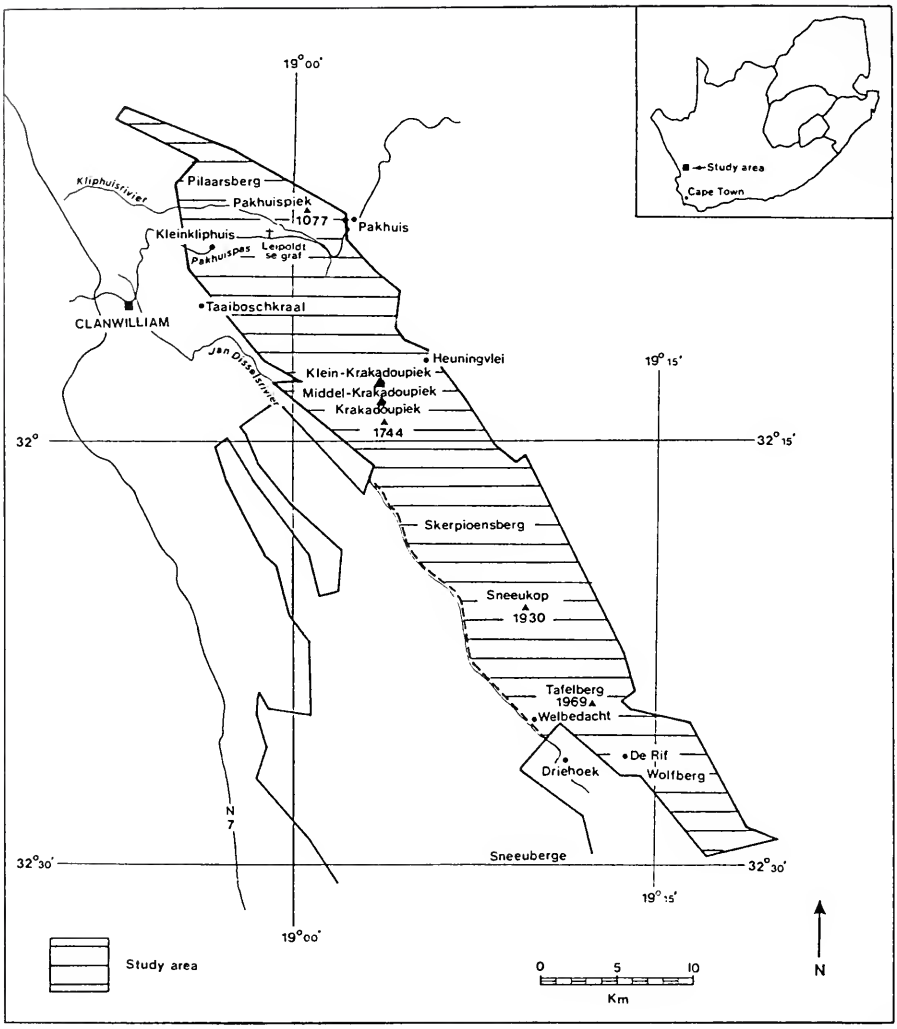

FIGURE 1.—Map of the study area in the northern Cederberg.

berg has been under State control for over a hundred years (Andrag 1977) and its management has posed problems to conservationists ever since, yet there has been no detailed floristic survey of the vegetation of the area.

The Cederberg is, moreover, a proclaimed Wilderness Area (Ackerman 1972; 1979; Van Zyl 1974)—one of the first in South Africa. It is essential, therefore, that the Ce-derberg should be managed as a 'shop window' where professionalism of conservation management is evident to its many visitors so that its status as true wilderness will be assured for the future. To this end, the phytosociological study of the Cederberg was undertaken, firstly to inform conservation managers on the habitats and plant communities in their care, and secondly to contribute data on a little-known category of fynbos to the inventory of plant communities in South Africa (Scheepers 1983).

This study was originally planned to cover the whole of the Cederberg Mountain Catchment Area (MCA) proclaimed in terms of the Mountain Catchment Act No. 63 of 1970 and currently managed by the Department of Nature and Environmental Conservation of the Cape Provincial Administration. This area comprises 67 000 ha of Forest Reserve that was already protected at the time of proclamation, and 59 000 ha of adjoining privately owned land. Most of the State land, 64 400 ha according to Erasmus (1984), was proclaimed a Wilderness Area by Government Notices in 1973 and 1976 (Bands 1978). The boundaries of the Wilderness Area, non-Wilderness State Forest and the Mountain Catchment Area are shown on the 1:50 000 Cederberg map compiled by the Chief Director of Surveys and Mapping.

After a reconnaissance of the whole MCA in 1985 it was decided, for practical reasons, to limit the semi-detailed survey to the northern and northeastern part of the Cederberg (Figure 1) including the cedar regeneration study sites in the Welbedacht-Wolfberg area. Data gathering began in January 1986 and was completed towards the end of 1987.

2. Physical environment and historical perspective

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Topography and geomorphology

The Cederberg lies close to the northern limit of the Cape Fold Belt of mountains that dominate the Capensis Region. In the Cederberg the range trends in a northwesterly direction. The mountains were formed by upthrust and folding of the sedimentary rocks and subsequent extensive faulting. The drainage follows fault lines and angular lines of weakness in the sandstone beds, giving rise to a typical rectangular pattern. The quartzitic sandstones are relatively resistant to weathering, the shales and mudstones of the 'shale bands' less so.

The mountains rise steeply from the Olifants River valley in the west. Citrusdal, at about 170 m above sea level, is barely 17 km from Sneeuberg which, at 2 027 m, is the highest peak in the range. Further north, the difference in altitude between the summit of Krakadouw Peak and the Jan Dissels River, 4 km westward, is 1 450 m. The Cederberg is the northern spine of the watershed between the Olifants River to the west and the Tankwa-Doring River system to the east (Figure 2). The mountain range is breached in the centre by a valley. From the divide at Uitkyk Pass, the Rondegat River runs roughly northwest to join the Olifants River at the head of the Clanwilliam Dam. The Driehoeks River, later the Matjies River, flows slightly south of east into the Doring River which meanders northward and westward, finally cutting through the Nardouw Mountains to join the Olifants River not far from its mouth. The Cederberg Mountain Catchment Area is an important part of the total catchment of the Olifants River system.

The topography is typical of regions where an arid climate with pronounced seasonal differences in temperature and precipitation controls the erosion cycle. The Table Mountain Group in the Cederberg is relatively little folded and tilted so that the flattish mountain tops are almost horizontal (Figure 3). This gives rise to a typical weathering pattern of massive rock groups sculptured by wind and weather into remarkable and characteristic shapes, separated by sandy flats or parallel fissures. The topographic sequence from valley bottom to mountain top is typically as follows: lower boulder-strewn slopes—steeper talus slopes—steep bare broken rock or cliffs—narrow plateau-like step, the 'trap' or 'shale band'. From this step the sequence is repeated, the upper cliffs being topped by very small to quite extensive plateaux. 'High cliffs, bouldery lower slopes and prominent scarps and crests contrast with extensive basins and subsummit plateaux' (Campbell 1985).

The Cederberg is built almost entirely of the sedimentary rocks of the Table Mountain Group within the Ordovician to Devonian Cape Supergroup, with some remnants of the older Malmesbury shales near the Olifants River in the west (e.g. at Patrysberg) and an abrupt transition to the younger Bokkeveld formations along the Moordenaarsgat River to the east.

Four formations of the Table Mountain Group of the Cape Supergroup (South African Committee for Stratigraphy 1980) are represented in the Cederberg. From top to bottom these are:

1. The Nardouw Formation, consisting of coarse-grained orthoquartzites, with occasional pebbles and lenses of vein quartz (Truswell 1970). It is characteristically redder than the Peninsula Formation and the dense linear drainage or weathering pattern is distinguishable on aerial photographs. In the Cederberg this formation is prominent in the plateau-like summits north of Pakhuis Peak and on Sneeukop, Tafelberg and other peaks above the shale band. North of the Cederberg it builds the Nardouw Escarpment, and in the south forms the Skurweberg Range of the Bokkeveld.

2. The Cederberg Formation (the shale band) is composed of shale and siltstone interbedded with fine-grained sandstone. It is a feature in the landscape, forming a narrow green band that contrasts sharply with the bare rocky quartzites below. It is fossiliferous, and lacks the pockmarks or 'heuweltjies' characteristic of the Malmesbury and Bokkeveld shales.

3. The Pakhuis Formation is the thin layer of tillite, or glacial mudstones and related rocks, immediately below the shale band. It contains random-sized pebbles some of which have been facetted and striated during the movement of ice over the underlying rock pavement. On Pakhuis Pass and at Groenberg remnants of the glacial

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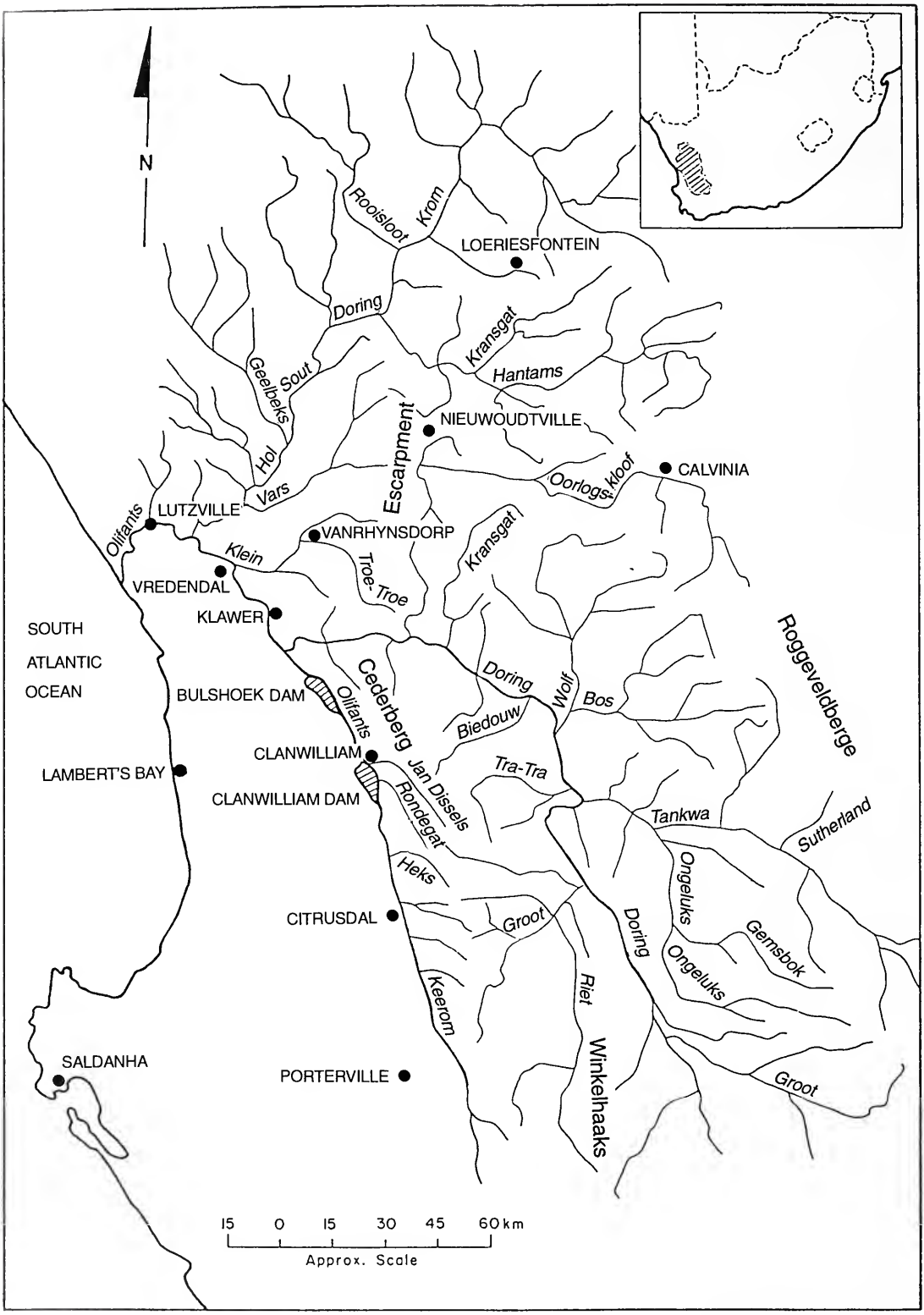


FIGURE 2.—The Olifants River catchment. From Morant (1984) redrawn from Scott (1982).

FIGURE 3.—Very broken country south of Pakhuis Pass where the high sandy plateaux drop step-wise to a lower level in the west. Vegetation is a fragmented mosaic of Sand Thicket Community (No. 4), Peninsula Bedrock Communities (Nos. 6 & 7) and Sandflats Community (No. 18). Beyond is the Pakhuis shaleband and the Pakhuis range. Note the level rock strata.

pavement are exposed, showing the deep irregular grooves made by the passage of the ice.

4. The Peninsula Formation, like the Nardouw, is a very thick deposit of coarse-grained quartzitic sandstones with occasional white quartz pebble deposits. Sand-shale lenses of various sizes occur throughout this formation. This formation comprises all those parts of the Cederberg from which the upper strata have been eroded away, i.e. southward from Pakhuis Pass, including Krakadouw, Middelberg, Vensterberg and Maraisberg, but excluding the eastern peaks from Sneeukop to Sandfontein.

Two other formations, the Graafwater Formation (purple to pink thinly bedded sandstone, siltstone and shale —the former 'lower shale' and the Piekenier Formation (conglomerate and sandstone) do not occur in the Cederberg. They are the lowermost strata of the Table Mountain Group and can be seen in road cuttings on the western side of Piekenierskloof Pass. Rust (1967) describes all these formations in great detail.

Soils

Soils of the western mountains are coarser textured than those in the eastern parts of the Fynbos Biome. Cederberg soils are often yellow-brown to brown, rather then greyish in colour (Campbell 1983). This may be because quartzites in the northern areas are apparently higher in iron oxides than elsewhere in the fold zone (Lambrechts 1979).

Except for small pockets of sandy loam to clay loam soils, generally derived from the shales and mudstones of the Cederberg Formation, soils are highly leached acid sands, low in nutrients and with low moisture-retaining capacity. On rocky slopes, soils are skeletal and mainly of the Mispah and Glenrosa Forms, porous with rapid internal drainage and therefore resistant to normal water erosion. There is little mass wastage. Accelerated sheet erosion is sometimes observed after fires. On plateaux or wherever there is a break in slope where materials accumulate, deep sands develop giving rise to soils of the Fernwood Form. These are usually highly susceptible to gully erosion.

Smit (1970) gives the milli-equivalent cation absorption capacity of upper Olifants River soils near Citrusdal, as below 4, often as low as 2, with pH from 4.5 to 6.5. It can safely be assumed that the soils of the catchment are as poor in nutrients or poorer than these.

Climate

The mediterranean climatic cycle in the Fynbos Biome, with wet winters and dry summers, has been described in broad terms by many authors (e.g. Jackson & Tyson 1971; Kruger 1979a; Fuggle 1981). In more detail, Fuggle & Ashton (1979) have summarized the variation in climatic elements such as solar radiation, temperature and rainfall; Campbell (1983) has analysed this variability in relation to environmental gradients, and Van Wilgen (1984) has divided the fynbos climate into fire climate zones for the purposes of fire management.

Climate stations are conspicuously absent from the mountainous areas of the Fynbos Biome, especially in the northwest (see, for instance, fig. 1 in Fuggle & Ashton 1979). Climate diagrams and detailed comparative data are unfortunately not available and only some generalizations can be made.

First, the proportion of winter rain is highest in the west of the Biome and precipitation decreases northwards. The Cederberg, which is among the most westerly and northerly of fynbos mountains, receives at least 80% of its rain in the three winter months but its annual total is lower than in most other Cape mountains. Secondly, greater seasonal temperature ranges and higher annual pan evaporation are recorded in the west where greater amounts are evaporated during summer (Campbell 1983). Thirdly, there are local gradients in precipitation: increasing from low valleys to the high peaks, decreasing from the coast-facing to the interior sides of the mountains. Finally, there is the aspect gradient, with pronounced differences in radiation between north and south, the north

receiving much more energy than the equivalent south aspects, especially in winter (Campbell 1983).

All these factors make for great variation in the local climates of the Cederberg, with corresponding variation in vegetation. The mountains above 1 000 m receive much more rain than the valleys. Middelberg, for instance, has an average annual rainfall of 939 mm, Algeria in the valley below, 647 mm, and Kromrivier valley, further east, 407 mm (Bands 1978). Some of the high-altitude precipitation is in the form of mist, though there is less southeast cloud in summer than on the more southerly ranges. Precipitation decreases eastward and northward. Snow falls on the higher peaks nearly every winter but does not lie longer than a few days. Convection storms along the eastern margin usually occur in spring and autumn but are seldom accompanied by hail.

Night temperatures in winter frequently drop below freezing point and frost is common, especially on the higher plateaux. Summer temperatures frequently rise to 25°C or 30°C and extremes of over 40°C in January and February are not uncommon.

The prevailing winds (southeast in summer, northwest in winter) are not as strong or persistent as they are further south. Hot, dry northerly berg winds increase the fire hazard in the spring.

Land use and the biota

For millennia before European occupation, and until the latter half of the eighteenth century, both San (Bushman) and Khoi (Hottentot) clans lived in the Cederberg area. The San were hunter-gatherers and may have deliberately burned the veld to encourage game to concentrate and to stimulate growth and reproduction of edible bulbous plants (Klein 1974). In the final century of their occupation the San, harassed first by invading Khoi tribes and later by European frontier farmers (trekboere) retreated into the mountains and may have lived in the caves there for years with large herds of stolen livestock (Johnson 1979; Penn 1984). They have left rock paintings in overhangs at lower altitudes but seldom in the caves above 1 000 m.

The Khoi, occupying the coastal forelands, river valleys and lower mountain slopes, were pastoralists and are reported by a number of writers to have habitually burned the veld to provide pasture for their sheep (Brown 1875; Botha 1924; Mossop 1927; Thompson 1936; Schweitzer & Scott 1973). The Khoi may have used the Strandveld only as winter grazing and migrated annually into or beyond the mountains in summer.

Stock farming was the earliest activity of the trekboere who penetrated the west coast and Olifants River valley in the first half of the eighteenth century. These farmers used the mountains for grazing and adopted a patch-burn system of veld management which is still in use in some places today. The same treatment was used to encourage the production of buchu, *Agathosma betulina*, an aromatic shrub cultivated on a commercial scale for medicinal and pharmaceutical uses. In those days small homesteads and stock posts were scattered in remote parts of the Cederberg and small patches of suitable ground were cultivated and planted to annual crops. These patches are now all abandoned but may still be recognized by the occasional shade tree and the degraded weedy vegetation that remain as testimony to this early mountain agriculture (Bands 1978).

From the time they were first reported in about 1760, the Clanwilliam cedars *Widdringtonia cedarbergensis* rapidly became an important source of timber. From the earliest written accounts of these woodlands (so-called 'forests') in 1805 (Smith 1955) to the time when all felling was finally stopped in 1967 (Bands 1978) the history of their ruthless exploitation has been well documented (for summaries, see Hubbard 1937; Smith 1955; Lückhoff 1971; Andrag 1977; Bands 1978; Manders 1981). Through overexploitation, frequent fires and a possible increase in seed predation, the cedar populations have been reduced to a point where their recovery by natural regeneration may be problematical (Manders 1986). Recent research is aimed at improving the chances of survival of the species (Manders 1986; Manders & Botha 1989; Higgins *et al.* 1989; Botha 1990; Manders *et al.* 1990). Ever since about 1900 when Forester Bath drew up the first fire-protection scheme, manipulation of mountain vegetation, including the cedars, by fire or protection from fire, has been attempted (Clayton 1954; Bands 1977; Kruger 1977). Fire management is still the subject of experimental research (Kruger & Haynes 1978; Manders 1987a & b; Brown *et al.* 1991) and monitoring (Van Wilgen 1980).

The degradation of habitats was aggravated by both grazing and the harvesting of natural products of the mountains, for example buchu, bush tea [*Aspalathus linearis* (Burm. f.) R. Dahlgren] and tan bark [from *Protea nitida* Mill., *P. repens* (L.) L., *Heeria argentea* (Thunb.) Meisn. and *Colpoon compressum* P.J. Bergius]. On State Forest these practices were stopped between 1937 (grazing) and 1969 (bush tea) although emergency local grazing was allowed as late at 1967. On the privately owned land within the MCA, on the other hand, pasturing of sheep, goats and cattle, harvesting of buchu and wild flowers, and cultivation of bush tea are still practised today, and may be allowed to continue under control (Bands 1978).

Soon after 1897, when part of the Cederberg was declared a 'demarcated forest', a plantation of fast-growing exotic trees was established at Algeria to provide an alternative source of timber. At higher elevations, trial plantings of Clanwilliam cedar were also established but generally these have not thrived.

Since the proclamation of the Cederberg MCA in 1976, the foremost management objective on State land has been water conservation, followed by nature conservation and outdoor recreation. It is evident from Figure 2 that the MCA is an important part of the total catchment of the Olifants River.

Wild life in the Cederberg, according to Bands (1978, appendix 3) comprises 65 species of mammals, 193 birds, 8 amphibians, 48 reptiles and 14 fish. Mountains in the southwestern Cape have a fairly uniform fauna but the Cederberg, lying on the borders of the Karoo, harbours

certain Karoo species not usually found in fynbos mountains (Rautenbach & Nel 1980). Some noteworthy examples of such species are aardwolf, bat-eared fox, 'namtap' *Graphiurus ocularis* (Channing 1987), leopard, Clanwilliam yellow fish and black eagle. Rodent species are quite numerous and may be an important factor in predation on plant seeds. The fish fauna requires careful conservation: eight species are endemic to the Olifants River system, of which six are rare, vulnerable or endangered (Scott 1982). Aquatic systems are oligotrophic and would be particularly sensitive to enrichment (Scott 1982).

Bands (1978: appendix 2.2) gives a list of 63 rare, endangered, endemic or otherwise interesting plant species that may require special conservation management. Invasive alien plant species are no longer a serious problem on State land but need to be controlled on private land within the MCA. Bands (1978: appendix 2.3) records 13 invasives within the MCA. Among the most dangerous are, *Nerium oleander* L., *Prosopis grandulosa* Torr. var. *grandulosa* and *Sesbania punicea* (Cav.) Benth.

Regarding outdoor recreation patterns, Andrag (1977) found that swimming pools, both natural and man-made, are the greatest single attraction, and that only 23% of the total number of visitor groups to the State Forest actually hiked or slept overnight in the Wilderness. There is a need for careful regulation of the numbers and activities of people, not only to prevent degradation of ecosystems but especially to retain the Wilderness attribute of solitude.

History of vegetation description

Of the many pioneers who opened up the northwestern frontiers in search of the legendary copper mines and other spoils, none apparently penetrated the Cederberg. This is not surprising considering the inhospitable terrain, the unpredictable San (Bushmen) and the lack of incentive to explore the arid interior. The general impression gained from accounts of the Strandveld route is the variability in condition of the veld. Abundant grazing and clear, sweet water of the rainy season in good years alternated with barren sand, molehills, hard thorny bushes and muddy pools in the drought periods. On the other hand, early travellers who skirted the mountains reported much grass, good firewood, large forests and impenetrable scrub. Among these were Valentyn who travelled along the Piketberg in 1685 and Starrenberg who reported from near Porterville in 1705 (Skead 1980). Among those who later crossed into the Olifants River valley was Barrow in 1798 who found 'a new sort of country' and Alexander in 1836 who reported that a fine river 'ran full and clear between steep banks which were lined with mimosas and willows' (Skead 1980). In 1774 Thunberg, with Masson, did ascend the northern Bokkeveld escarpment to the Nieuwoudtville plateau and beyond to the Roggeveld, reporting bulbous plants everywhere and discovering the kokerboom, *Aloe dichotoma* Masson. The Cederberg, however, remained unexplored until Zeyher collected there in 1828 and again in 1831 when he met C.F. Drège. Apart from details of their plant collections, the only record of this expedition is the diary of Drège (Gunn & Codd 1981).

These early botanical travellers who ventured into the mountains were more concerned with collecting the flora than describing the vegetation. It was the brother J.F. Drège who, with E.H.F. Meyer, produced the first map and classification of the floral regions of the Cape in 1843. Later plant geographers of the nineteenth century, attempting to subdivide world biota, including those of South Africa, into biogeographical units, progressively improved the descriptions of the Capensis Region (Taylor 1978; Werger 1978), but Marloth (1908) was the first to make a detailed classification that included a specific description of the 'Cedarberg mountains'.

Since then there have been numerous but brief accounts of Cape mountain vegetation with some relevance to the Cederberg. Some writers described specific areas like the Hex River Mountains (Marloth 1896), the Little Karoo mountains (Levyns 1938), the Kamiesberg (Adamson 1938), the Olifants River Mountains (Milton & Linder 1980) and a portion of the Clanwilliam District (Milton 1978). Others covered wider topics such as the alpine vegetation of high peaks (Marloth 1929), the Cape/Karoo contact (Marloth 1923), the extent of the Cape flora (Marloth 1902) and overviews of broad vegetation zones (Taylor 1963; Taylor & Boucher 1973; Moll *et al.* 1984); but only two short papers (Taylor 1970, 1976) and a brief but interesting phytosociological account (Mustart *et al.* 1993) described specific plant communities in the Cederberg. Other works that incidentally dealt with the vegetation of the Cederberg—apart from the early accounts of the cedars referred to in the previous section and a popular account by Lückhoff (1980)—are those of Andrag (1977) and Bands (1978).

Andrag (1977) devised a simple community classification based on structure (height and percentage crown cover of the dominant stratum) with dominant species allocated to one of five physiognomic classes—grass, restio, shrub (narrow- and broad-leaved) and tree. By means of these categories he devised an ingenious classification consisting of seven basic vegetation units which could, if necessary, be further subdivided by the species that was dominant or conspicuous in each unit. The seven categories are: tall shrub-restioveld, low shrub-restioveld, waboomveld, shale-band vegetation, riverine scrub, dry kloof forest and wet kloof forest, the latter corresponding to the Knysna Forest, Veld Type 4 of Acocks (1988).

These were good enough for Andrag's purpose (characterization of the vegetation in relation to the occurrence of the Clanwilliam cedar) but for provisional management of the whole of the Cederberg, Bands (1978) felt that somewhat more detailed subdivision was necessary. He sought to obtain vegetation units that were identifiable on aerial photographs so as to allow mapping units of broad types without recourse to very expensive and time-consuming ground surveys. This he achieved by differentiating subtypes of Andrag's low shrub-restioveld and waboomveld, resulting in a total of twelve plant communites.

By using this system, Bands was able to state that, apart from a very few small remnants of forest akin to Acocks's Veld Type 4 to be found in sheltered kloofs, the

whole of the Cederberg vegetation could be classified as Acocks's Veld Type 69, Fynbos. A decrease in plant cover and in importance of Restionaceae and other fynbos forms and an increase in the number and variety of succulents in the vicinity of Clanwilliam and Pakhuis Pass in the north, and in the southeast between Matjiesrivier, Rietkloof and Pompieshoek, indicated the transition to Karoo vegetation (Acocks's Veld Type 31, Succulent Karoo; and 26, Karroid Broken Veld). Also evident was the abrupt change from fynbos to typical karooveld east of the fault line marked for much of its length by the Moordenaarsgat River, which is also the contact line between Table Mountain sandstones and Bokkeveld shales.

Bands's classification, effective though it was for broad-scale interim management of the area, was based essentially on gross physiognomy of the vegetation. For sophisticated management and for monitoring the finer responses of vegetation to treatment, a classification based upon full floristic composition is required. The aim of this present study is to attain a classification of this kind.

3. Floristic classification of the northern Cederberg

Introduction

Campbell's (1985) structural classification of the mountain vegetation of the Fynbos Biome (which includes the Cederberg) is the first step from generalized to specific vegetation description after Acocks's (1988) veld types, but an evaluation of Campbell's work was not within the scope of my project as approved by the Botanical Research Institute (now the National Botanical Institute) in 1983. Hence, the structural data I collected, based on the simpler classifications of Campbell *et al.* (1981) and Edwards (1983), were insufficient to enable me to identify the communities of Campbell (1985) with certainty. Nevertheless, in my community descriptions I have attempted to make some broad comparisons with Campbell's structural units and to discuss these briefly in the final pages.

The northern ranges in the Fynbos Biome are mapped by Acocks (1988) as Fynbos (Veld Type 69) and by Moll *et al.* (1984) as Mesic Mountain Fynbos. However the latter authors state (p.19) that their concept of Mesic Mountain Fynbos in the Cederberg may prove to be more xeric than the typical form. This view is strengthened by the fact that some taxa characteristic of the moister southern parts of Mesic Mountain Fynbos, e.g. the family Penaeaceae and the genus *Mimetes*, are absent in the Cederberg and all other ranges north of the Cold Bokkeveld. It is likely too that the mountain vegetation of the Cederberg has been more degraded over the last two centuries than the majority of Cape ranges due to the ruthless exploitation of the Clanwilliam cedar and other economically important species, the heavy grazing by domestic stock until about 50 years ago (Bands 1978) and the frequent extensive wildfires of the last two or three decades.

Methods of sampling and synthesis

Sampling and synthesis were according to the Braun-Blanquet method described by Mueller-Dombois & Ellenberg (1974) and Werger (1974).

Where it was possible to recognize distinct physiognomic-physiographic units on the 1:40 000 aerial photographs, sampling sites were located on a stratified-random basis by means of random-dot templates placed over the aerial photographs. In very broken terrain where small and distinct communities were easily recognized on the ground, a degree of objectivity was achieved by pacing a fixed distance towards the centre of the community. The prime consideration, however, was always homogeneity of the vegetation, not randomness of the sample.

Because Cederberg vegetation is near the dry end of the fynbos gradient, it was thought advisable to determine whether the quadrat size of 50 m^2, often used for fynbos, was suitable for this survey. The results of a nested-quadrat test (Werger *et al.* 1972) on a range of physiognomic types in the Cederberg showed that a size of between 50 m^2 and 100 m^2 would yield optimum information gained in relation to sampling time by the criteria of Werger (1972). Hence, our standard plot-demarcator of 5 m × 10 m divided by strings into ten equal subplots, was supplemented by a surrounding width of about 1.5 m to bring the total quadrat size to 100 m^2 for fynbos. In the coarser-patterned thicket vegetation, a variously shaped quadrat size of 200 m^2 was used. Nearly every quadrat was permanently marked with its number embossed on an aluminium tag placed usually in a stone cairn at the 'bottom left' corner of the rectangular plot. On level ground the length of the plot faced roughly north; on slopes the length was along the contour.

For each quadrat a standard form was used to list all species with their cover-abundance values according to the Braun-Blanquet scale. Species present only in the surround were designated 'O'. 'R' indicates 'rare'. The total cover of vegetation canopy, litter and rock was estimated in percentages and the following data were recorded: date of survey, location to the nearest one-ninth of a quarter-degree-square, land facet (Scheepers 1975) altitude, aspect, slope, geological formation (Rust 1967), substrate, and estimates of soil depth in centimetres, soil moisture, post-burn age of vegetation and amount of disturbance. In order to place each quadrat in the structural classifications of both Campbell *et al.* (1981) and Edwards (1983), the height of each stratum, its total cover and the cover in Braun-Blanquet values of various structural attributes of stems and leaves were recorded. Notes were made on dominant species, biotic influences, water regime, and pattern and extent of the community. The species list together with the abovementioned data for each quadrat is henceforth referred to as a relevé. A photograph, usually black-and-white, of nearly every relevé was taken.

The 157 relevés of the main survey (undertaken in 1986 and 1987) were supplemented by 23 taken during reconnaissance and 11 in riverine thicket (1988), bringing the total number to 191 relevés.

The PHYTOTAB package of programs (Westfall *et al.* 1982) was used to classify the vegetation according to Braun-Blanquet's phytosociological method.

Species occurring only once in the matrix were excluded from the phytosociological analysis. The geophytes and annuals that were not permanently recognizable were included in the non-diagnostic species (Group BI of Appendix 2) since their seasonal presence above-ground ren-

ders them unreliable as indicators of a plant community. Species that could not be named in the field were collected for identification; for those that were not identifiable, 'field specimens' were retained for matching with authenticated material. Taxa that could be identified only to genus level were given a collection number if they were individually collected. If not, the epithet sp. is appended, and then the concept may include several species within the genus. Where two taxa in vegetative condition were indistinguishable in the field they were of necessity 'lumped' and given a code name, e.g. *Ehrharta c/v* for *Ehrharta calycina* and *E. villosa*, *Ehrharta b/c* for *Ehrharta bulbosa* and *E. capensis*, and *Macrostylis t/d* for *Macrostylis tenuis* and *M. decipiens*.

At a late stage in the table-sorting process, 17 relevés that clearly appeared to be heterogeneous were removed from the matrix after having been evaluated. Though a few of these unclassified relevés may reflect transitional or unrepresentative situations, most of them probably represent minor communities sampled once only. The relatively high number of these demonstrates the high habitat diversity in much-dissected mountain topography. For the benefit of future workers, these 17 relevés have been included on the right-hand side of Appendix 2.

Classification

Since the nature of mountain fynbos communities over a wide range of habitats is as yet insufficiently known, the communities in the northern Cederberg have not been ranked in a formal hierarchy (Werger *et al.* 1972; Coetzee 1974). Nevertheless, the 26 communities revealed by the phytosociological analysis can be grouped naturally into larger units based on species with broader amplitudes. The floristic-habitat relationships in this informal ranking are shown in Figures 4–6.

In accordance with the recommendations for a standardized South African syntaxonomic nomenclature (Scheepers *et al.* unpubl.) each community name is based on two diagnostic species, the first a species of broader amplitude (if possible a dominant), the second a differential species, i.e. one with high presence and fidelity in the specific community being described. In the Cederberg, as in most mountain fynbos, some communities, especially impoverished communities under stress, as at high altitudes, lack good differentials. In such cases two species with wider amplitude but high presence within the relevant community were chosen for the name.

In the community descriptions, information is given in a standard format. The structural category, averaged for each community, is that devised for the vegetation of the Fynbos Biome by Campbell *et al.* (1981). This is followed by a list of relevés sampled (with the total number in brackets); the average and range of species richness; and a reference to the 'diagnostic species group' in Appendix 2. Finally there are standardized descriptions of the vegetation with the dominants listed separately; the locality and environment; and special features peculiar to each community. In the environmental description the land facet number (in brackets) refers to the classification of Scheepers (1975); the geological formation code (in brackets) is that given in the legend on the 1:250 000 Geological Series map, 3218 Clanwilliam sheet, published by the Government Printer, Pretoria, in 1973.

The plant communities

Two contrasting structural categories of vegetation are immediately apparent: fynbos and broad-leaved thicket. The latter, allied to Acocks's (1988) Veld Type 4, is rare in the Cederberg, occurring in river kloofs and on screes that provide natural protection from fire (Communities 1–4, Figure 4). Fynbos is the vegetation of all fire-prone habitats—probably over 95% of the area. The Cederberg

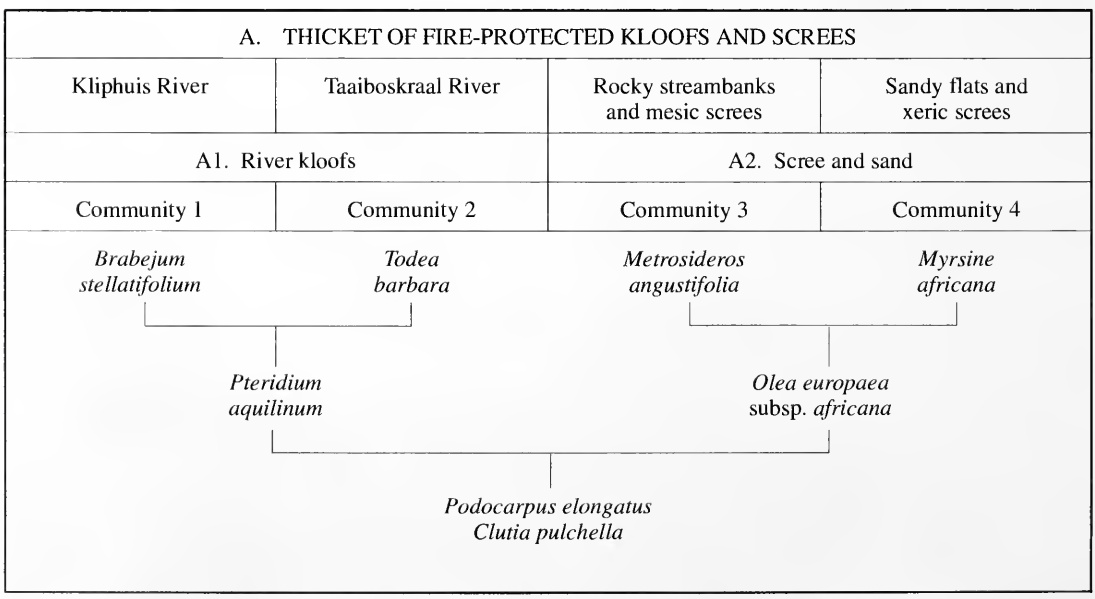
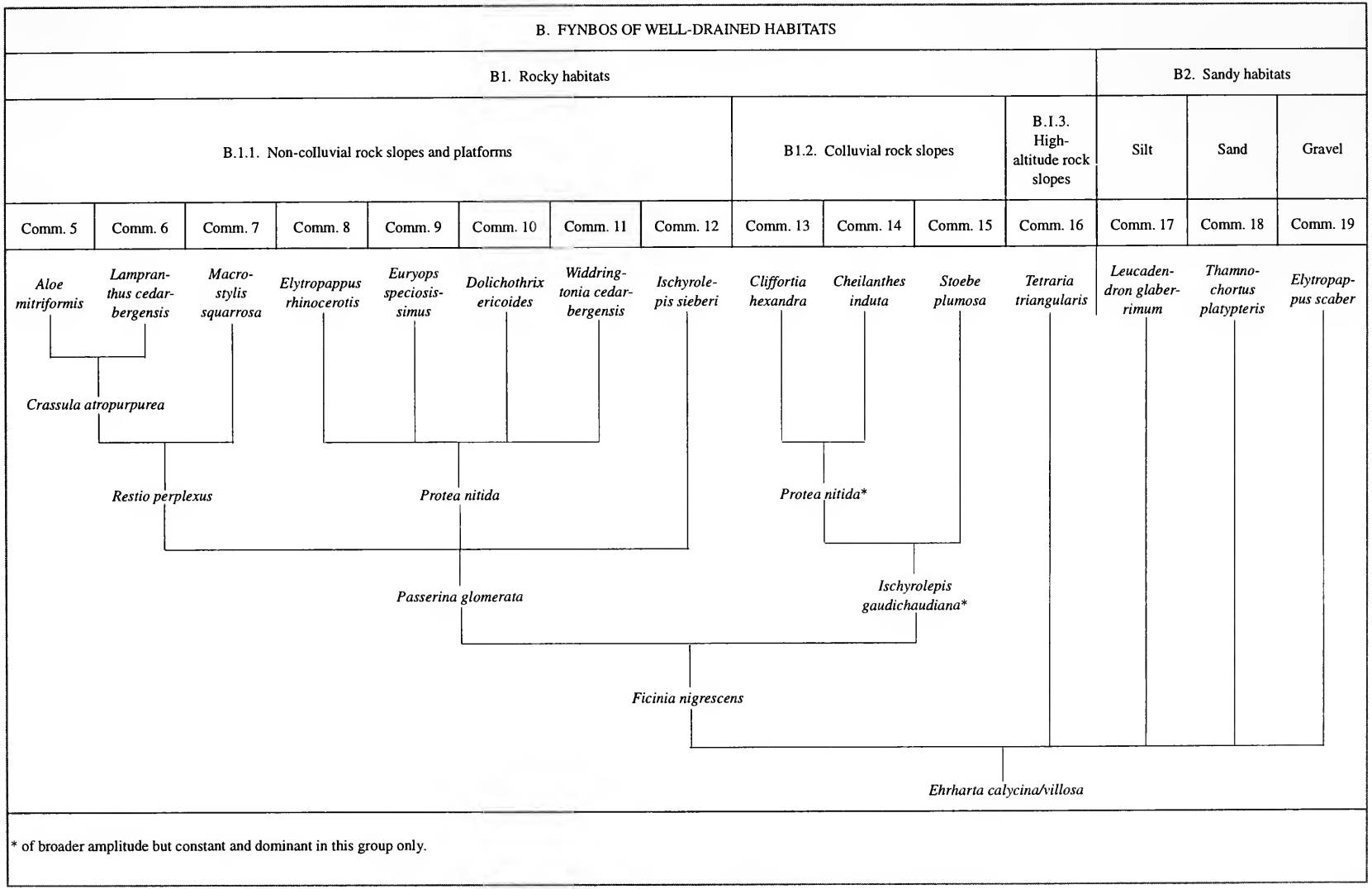


FIGURE 4.—Floristic-habitat relationships in the northern Cederberg: Thicket of fire-protected kloofs and screes.



* of broader amplitude but constant and dominant in this group only.

FIGURE 5.—Floristic-habitat relationships in the northern Cederberg: Fynbos of well-drained habitats.

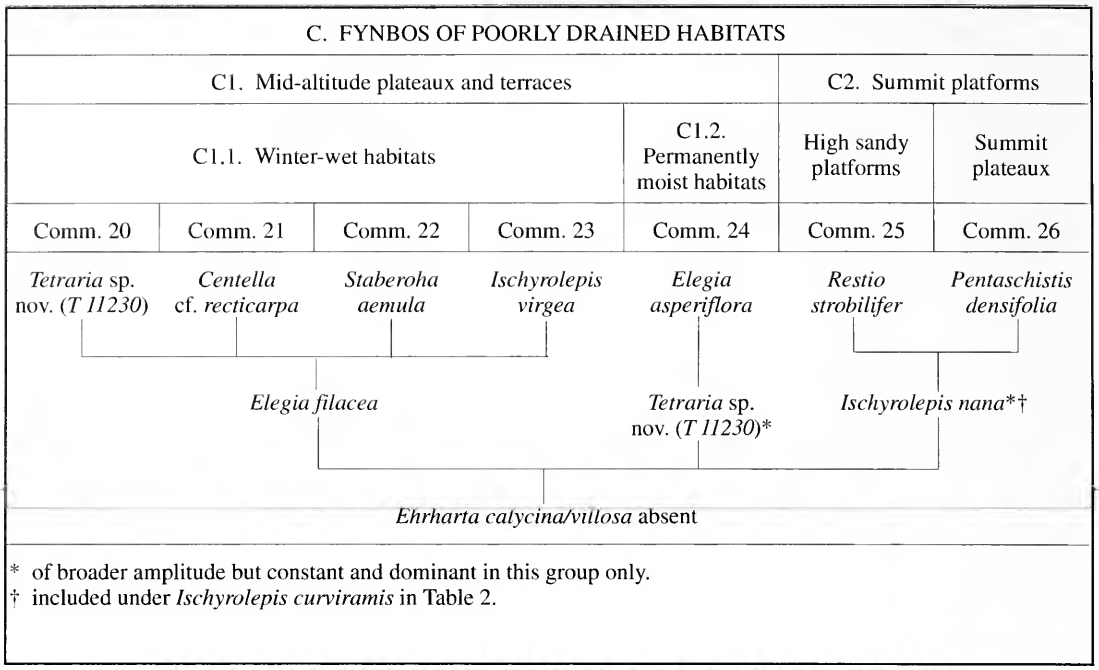


FIGURE 6.—Floristic-habitat relationships in the northern Cederberg: Fynbos of poorly drained habitats.

has a simple geological structure but a complex variety of habitats broadly distinguished in the first place by amount and seasonality of soil moisture. Communities 5 to 19 (Figure 5) comprising by far the larger part of the area, occur on sites where drainage is good; communities 20 to 26 (Figure 6) occur at upper altitudes where the shallow soil is wet or waterlogged for at least part of the year. Further subdivisions are shown in Figures 4 to 6 and discussed in the text.

A. THICKET OF FIRE-PROTECTED KLOOFS AND SCREES (Communities 1–4)

Only two species, the tree *Podocarpus elongatus*, and the forest-margin undershrub *Clutia pulchella*, are exclusive to all four thicket communities in the northern Cederberg but neither have high presence except in the moister, best developed parts. Thickets were only sampled in the area from Krakadou northwards. There are no thickets in the Welbedacht area (Figure 1).

1. **River kloofs** (Communities 1 & 2)

Two river kloofs were sampled. The fact that each has a different community suggests that more extensive sampling is needed in this habitat type. In the northern Cederberg, River kloof thickets are found only along streams draining westward into the Olifants River.

** The classification of Campbell *et al.* (1981) does not have a category for thicket; their Low Forest in the Cederberg is roughly equivalent to the Short Thicket/Low Thicket categories in the national structural classification of Edwards (1983).

Community 1 *Pteridium aquilinum–Brabejum stellatifolium* Community on sandy streambanks in the Kliphuis River kloof (Figure 7)

Structural category: low forest**
Relevés: (6) 181, 182, 183, 185, 186 & 187
Species richness: 14 (13–15)
Species group (Appendix 2): A

Vegetation: mature (except relevé 185) with 100% cover; two strata, the upper of trees 5–6 m, the lower of forest shrubs and bracken to 1.5 m.

Dominants: *Brabejum stellatifolium* (differential) and *Metrosideros angustifolia* (differential) in the tree layer, *Prionium serratum* in the shrub layer on sandy banks.

Locality and environment: only recorded in Kliphuis River kloof in relatively broad-based but deep kloofs (land facet 04) or, for relevé 185, upper watercourses (land facet 01), at altitudes below 550 m; almost level, on TMS of the Peninsula Formation (geological formation C1Q1) with a usually shallow substrate of humic sand, some stones, little rock (except relevé 183) and low litter cover—possibly due to seasonal flushing. Annual rainfall approximately 400 mm.

Special features: riverine situation at lowest altitudes on permanently wet soil despite low rainfall. Non-dominants with high presence are *Brachylaena neriifolia* (tree layer) and the restioid *Calopsis paniculata* (shrub layer). In the northern Cederberg *Rhus angustifolia*, common in thickets further south, is near the northern end of its distribution range and occurs occasionally in this community only.

FIGURE 7.—*Pteridium aquilinum–Brabejum stellatifolium* Community (No 1) in the Kliphuis River Kloof, with trees 5–6 m tall. Dark crown on left is *Podocarpus elongatus*.

Community 2 *Pteridium aquilinum–Todea barbara* Community on sandy streambanks in the Taaiboskraal River kloof

Structural category: low forest
Relevés: (3) 188, 189 & 191
Species richness: 13 (12–14)
Species group (Appendix 2): nil

Vegetation: mature, 97–100% cover; two strata, the upper of trees 5–8 m, the lower of ferns and moisture-loving shrubs to 1.5 m. No diagnostic species.

Dominants: *Metrosideros angustifolia* in the tree layer and the distinctive restioid *Elegia capensis* in the shrub layer.

Locality and environment: only recorded in the Taaiboskraal River kloof along more or less incised watercourses (01, 03, 04) at altitudes around 650–750 m; slope 1°–3°, aspect WSW, on TMS of the Peninsula Formation (C1Q1) with 500 mm or less of sandy humic soil over bedrock and again low cover of litter; annual rainfall 600–700 mm.

Special features: as in Community 1, permanently wet soil but higher rainfall; vegetation similar to Community 1 but for the absence of *Brabejum stellatifolium* and several forest shrubs, the strong dominance of *Metrosideros angustifolia* (B-B cover 5), less bracken but several other fern species, and *Clutia pulchella* with low but consistent presence.

2. **Scree and sand** (Communities 3 & 4)

These communities are richer in species and more diverse in habitat than the river thickets. They share with the Bedrock communities several species (Group K, Appendix 2) that thrive in rocky situations protected from fire. The form of *Cassine peragua* that occurs in these thickets has very narrow leaves and is easily confused with *Hartogiella schinoides*.

Community 3 *Olea europaea* subsp. *africana–Metrosideros angustifolia* Community on rocky streambanks and mesic screes

Structural category: low forest
Relevés: (5) 20, 44, 55, 140 & 190
Species richness: 23 (14–31)
Species group (Appendix 2): nil

Vegetation: mature but patchy, with canopy gaps: cover 80–100%; usually two strata, the upper 5–9 m tall, the lower 0.5–1.5. m, but relevé 20 on a moist, cool slope has an additional layer of tall undershrubs to 2.5 m. No diagnostic species.

Dominants: in the tree layer, *Metrosideros angustifolia*, *Heeria argentea*, *Podocarpus elongatus*, locally *Hartogiella schinoides* and *Maytenus oleoides*; locally in the shrub layers *Diospyros glabra* and *Myrica serrata*.

Locality and environment: scattered throughout the northern sector from Krakadoupoort to beyond Ribboksberg, including a gallery thicket on an east-flowing stream at Fortyn-se-Kloof (Relevé 55); land facets: stream ravines (03), plane slopes (5.1) or scree (4.3), at altitudes from 530–930 m on gentle to steep slopes (1°–40°), all aspects; TMS of the Peninsula Formation (C1Q1) except relevé 140 (Nardouw Formation, C1Q2); substrate of silty sand 0–60 cm deep with some organic matter, stones and boulders, soil well drained but moist because of either the phreatic situation or percolation beneath the scree; litter cover 10–55%, usually over broken bedrock (95% exposed) or, on the decomposed screes, covered by deeper soil with only 10–30% protruding rock. Annual rainfall 500–900 mm, generally around 650 mm.

Special features: the absence of diagnostic species exclusive to this community and the wide range in its environmental influences and habitats, indicates its transitional nature between the river thickets and those of scree and sand.

Community 4 *Olea europaea* subsp. *africana–Myrsine africana* Community on sandy flats and xeric screes (Figure 8)

Structural category: low forest
Relevés: (12) 9, 10, 11, 12, 13, 67, 80, 92, 135, 159, 160 & 184
Species richness: 23 (16–32)
Species group (Appendix 2): E

Vegetation: mature; cover 70–100%, usually over 95%. There are three strata, the upper of trees to 6.5 m tall, the intermediate of forest shrubs to 2 m, and the lower stratum of sub-shrubs, e.g. *Myrsine africana*, and herbs (*Stachys aethiopica*) usually less than 1 m in height. Ground mosses and rock lichens could be considered an additional layer of negligible height. The woody climber *Secamone alpini* commonly ascends to the tops of the trees.

Dominants: in the tree layer, *Olea europaea* subsp. *africana* with 100% presence and cover up to 50%, and *Heeria argentea*; less frequently *Cassine peragua* and *Maytenus oleoides*, and occasionally *Podocarpus elongatus* and *Kiggelaria africana*; in the intermediate layer *Hartogiella schinoides* and *Rhus undulata*.

Locality and environment: occurs in the Pakhuis area both north and south of the pass, usually along the edge of sandy flats adjoining the steep-cliffed 'boulder koppies' on their shady side, less commonly on xeric screes (land facets 2.1 or 4.3); level or almost level terrain on the flats but, on screes, sloping up to 35° with a southwesterly aspect; altitude 600–1 000 m; on TMS of Peninsula (C1Q1) and Nardouw (C1Q2) Formations; substrate always well drained, of white sand up to 60 cm deep on the flats, sometimes with rock at or close to the surface, especially on screes; rock cover 0–99%, litter cover 15–95%, not much decomposed. Rainfall from 300 mm at the lowest altitude to 600 mm at the highest.

Special features: diagnostic species for this community are not found in the tree canopy but in the lower strata, e.g. *Euclea lancea* in the tall shrub layer, *Euclea acutifolia*, *Anisodontea bryoniifolia* and *Stachys linearis* in the undershrub layer. These are species chiefly of drier regions (Namaqualand and Karoo) and are unlikely to be found in thickets further south. *Rhus tomentosa*, on the other hand, is widespread in southern Africa and characteristically occurs on thicket margins throughout the Cape Floristic Region. *Myrsine africana* has high presence in the lower stratum but is not confined to thickets; it occurs sparingly in fynbos communities that have rather deep soil and canopies casting appreciable shade. Subcommunity 3a of Mustart *et al.*(1993) is synonymous with this community.

Relationship of the thicket Communities 1–4 to Campbell's (1985) Scheme: Community 1, with *Brabejum stellatifolium* dominant, shows close relationship to Campbell's Witrivier Closed-Scrub Fynbos, a community that has been formally recognized by previous workers. In Community 2, the similarity to Closed-Scrub decreases and elements of the non-fynbos Afromontane Forest (*Halleria lucida* and mesic ferns) are present. The forest element persists in Community 3 which, in addition, contains a strong suite of species of the non-fynbos thicket group, principally Mitchell Thicket, e.g. *Olea europaea* subsp. *africana* (shared with Cape Thicket), *Hartogiella schinoides* and *Heeria argentea*. Community 4 lacks forest species but retains the full thicket element which is further strengthened by a group of its own diagnostics, including some with typical northern dry-shrubland distribution such as *Euclea lancea*, *Anisondontea bryoniifolia* and *Stachys linearis*. In structure, as in floristics, these communities intergrade.

B. FYNBOS OF WELL-DRAINED HABITATS
(Communities 5–19)

These fynbos communities, occurring on both rocky and sandy sites at all altitudes, are characterized by the

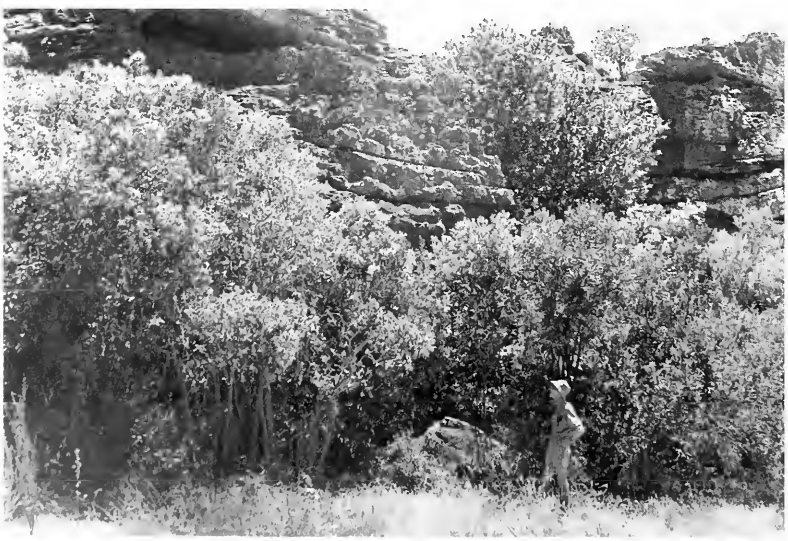


FIGURE 8.—*Olea europaea* subsp. *africana–Myrsine africana* Community (No. 4) on sandy flat at Leipoldt's Grave, relevé 9. *Cassine peragua* dominant in upper canopy; *Heeria argentea* in rocks above.

FIGURE 9.—*Crassula atropurpurea–Aloe mitriformis* Community (No. 5) on Nardouw bedrock, summit of Pilaarberg, 1 000 m, relevé 141. *Aloe mitriformis* is conspicuous in centre. *Ehrharta calycina/villosa* and *Pentaschistis eriostoma* dominate this relevé.

presence of one of the species in group AP (Appendix 2)—usually *Ehrharta calycina/villosa* but if not, then *Ischyrolepis sieberi*. Most communities of rocky habitats (Communities 5–16, rocky habitat group in Figure 5) are characterized by species in the *Ficinia nigrescens* group (AA, Appendix 2) but these are virtually absent in the high-altitude rock slope community (16) and in the sand communities (17–19, sandy habitat group in Figure 5).

1. **Rocky habitats** (Communities 5–16)

Virtually all the mountain slopes of the Cederberg fall into this category. Twelve communities are distinguished, some better defined than others. This rocky habitat group is floristically divided into three subgroups: Communities 5–12 defined by the presence of the *Passerina glomerata* species group (T, Appendix 2); Communities 13–15 characterized by the high presence and dominance of *Ischyrolepis gaudichaudiana*; Community 16 on high steep slopes forms a separate anomalous subgroup in which nearly all diagnostic species of well-drained rocky habitats are absent.

Communities 13–15 occupy lower mid-slopes strewn with rocks and boulders that have fallen from the cliffs above—here called the colluvial rock slopes (Harmse *et al.* 1984). This feature chiefly separates this subgroup from Communities 5–12 which occur on slopes and platforms where rockiness is due in greater measure to protruding bedrock than to surface debris.

1.1 **Non-colluvial rock slopes and platforms** (Communities 5–12)

The many different habitats occupied by this group are detailed in the text. Communities 5, 6 and 7 on bedrock platforms are clearly related to one another and may, in a formal classification, be mere variations of a single syntaxon. The relationship between communities 11 and 12 is less obvious; the latter, which has no diagnostics, may be merely a depauperate form of the former.

Community 5 *Crassula atropurpurea–Aloe mitriformis* Community on Nardouw bedrock platforms (Figure 9)

Structural category: low open shrubland with a graminoid-cyperoid-succulent understorey and mid-high emergent shrubs
Relevés: (7) 138, 141, 157, 173, 174, 175 & 176
Species richness: 28 (17–35)
Species group (Appendix 2): H

Vegetation: mature; cover generally 50–60% but can be below 25% in sites with much exposed bedrock; two strata, the upper to 1 m tall, of narrow-sclerophyllous shrubs, the lower to 0.6 m, hemicryptophytic (grasses, restioids and sedges) with succulents; emergent broad-leaved shrubs and low trees to 2 m.

Dominants: usually none, but species with high presence include: (1) upper stratum: the shrubs *Passerina glomerata, Eriocephalus africanus, Diosma acmaeophylla, Protasparagus suaveolens*; (2) lower stratum: *Ehrharta calycina/villosa, Pentaschistis eriostoma, Ficinia nigrescens* and succulents, especially *Crassula dejecta* and *Ruschia dichroa*; (3) emergents: *Protea glabra* and the dwarfed low tree *Heeria argentea*.

Locality and environment: mainly north of Pakhuis Pass, with one outlier east and another far south (Heuningvlei); on bedrock strata (land facet 1.2) level or sloping 5°–15° NW to NE at 900–1 000 m altitude (except Heuningvlei 700 m); TMS of Nardouw Formation (C1Q2) except the two outliers on the upper edge of the Peninsula Formation (C1Q1); substrate of very shallow (5 cm) coarse quartzitic sand, pebbles and stones, seldom with organic content or much litter (<10%), over bedrock 50–99% exposed. Annual rainfall ± 500 mm.

Special features: this is a harsh habitat. Bare rock covers at least half the surface. The shallow soil, usually dry and hot, is subject to seasonal extremes of moisture and temperature—briefly flooded after rain, frosty on cold winter

mornings. To these conditions the vegetation has responded with a diversity of xerophytic life forms—aphylly with green stems, sclerophylly, succulence and summer leaf-shedding.

Individual stands are usually small in extent, sometimes scarcely larger than the sample plot, like islands in a sea of rock, but the flora is quite rich: more than half the relevés have 31–35 species each. These include the rare *Agathosma distans*, the endemic *Schlechteria capensis* and several small recondite plants only conspicuous when briefly in flower, for example *Conophytum minusculum* (succulent), *Felicia cymbalariae* (annual) and *Lachenalia elegans* (geophyte). Crustose and foliose lichens thickly cover the open rock surfaces. The lanky emergent *Protea glabra* and the coarse wiry tangles of *Restio perplexus* are good indicators of this and the following community. Communities 5 & 6 also share with some thickets the species of Group K that can survive in dry sites wherever a large proportion of open rock provides some protection from fire.

Community 6 *Crassula atropurpurea–Lampranthus cedarbergensis* Community on Peninsula bedrock platforms (Figure 10)

Structural category: low open shrubland
Relevés: (8) 53, 68, 69, 71, 75, 79, 83 & 96
Species richness: 27 (22–30)
Species group (Appendix 2): I

Vegetation: mature; cover about 55%, less variable than Community 5; strata usually two but less distinct than in Community 5, the upper 50–200 cm, of both narrow- and broad-leaved sclerophyllous shrubs and occasionally a tall restioid; the lower usually below 50 cm, of narrow-sclerophyllous shrubs with hemicryptophytes and succulents, the two last-named sometimes distinguishable as a separate understorey.

Dominants: *Diosma acmaeophylla* usually in the upper stratum, *Restio perplexus* in the lower. Non-dominant species with high presence include the nanophyllous shrubs *Rhus rimosa* and *Phylica oleifolia* in the upper stratum, *Ehrharta calycina/villosa, Ficinia nigrescens, Lampranthus lunulatus, Crassula atropurpurea, Passerina glomerata* and *Stoebe intricata* in the lower.

Locality and environment: found on small rock platforms in the broken country of Pakhuis Pass between the Kliphuis and Taaiboskraal Rivers, especially along the jeep track between Leipoldt's Grave and Amon se Poort but also on isolated sites further south; on bedrock strata (land facet 1.2, sometimes as saucer-like depressions) level or sloping 2°–10° NW to NE at about 800–1 000 m altitude; TMS of Peninsula Formation (C1Q1); substrate less than 10 cm of sand, pebbles and stones, the sand pinkish on the surface, yellowish grey to brown below; negligible organic matter but undecomposed litter 10–30% over bedrock up to 98% exposed. Annual rainfall averages 700 mm.

Special features: habitat similar to Community 5; vegetation structure also similar but cover more uniform and stratification less distinct. Relevés have no more than 30 species and lack the rare and special species of Community 5. *Stoebe intricata* and *Aspalathus polycephala* are more prevalent and characteristic. *Cannomois taylorii*, a tall rhizomatous restiad in the upper stratum, forms quite large stands on bedrock at low altitudes but was only recorded in relevé 79.

Community 7 *Restio perplexus–Macrostylis squarrosa* Community on Peninsula bedrock outcrops

Structural category: low open shrubland
Relevés: (4) 4, 5, 6 & 48
Species richness: 28 (20–34)
Species group (Appendix 2): L

Vegetation: mature; cover 50–80%; basically one stratum of leptosclerophyll shrubs to 1 m, a lower graminoid-restioid element present to varying degrees but lacking the

FIGURE 10.—*Crassula atropurpurea–Lampranthus cedarbergensis* Community (No. 6) on Peninsula bedrock near Pakhuis Pass, 780 m, relevé 79. The tall, dark, erect restioid is *Cannomois taylorii*.

FIGURE 11.—*Ischyrolepis capensis–Elytropappus rhinocerotis* Community (No. 8) on Pakhuis Pass at 870 m, relevé 91. *Metalasia densa* with white flower heads in foreground, *Elytropappus rhinocerotis* beyond. *Protea nitida*, 2 m, on right. Below road, vegetation becomes mixed. Rocky area, left distance, is the Peninsula Bedrock Community (No. 6).

succulents of Communities 5 and 6; sometimes with shrubs emergent to 2 m but the broad-sclerophyllous shrub/tree element absent.

Dominants: *Stoebe intricata, Ischyrolepis sieberi,* sometimes *Merxmuellera arundinacea*, but none are invariably dominant or even present.

Locality and environment: occurs towards the western edge of Community 6 (Figure 3) and in the same general habitat, at altitudes below 900 m, on small bedrock outcrops that are not, as in Community 6, raised above the general level of the landscape but are contiguous with the sandflats Community 18 (land facet 2.1) and therefore likely to be more fire-prone than the foregoing communities.

Special features: the locally strong dominance of *Stoebe intricata* which appears to be a 'fire-weed' like *Stoebe plumosa* (also present in this community), and absence of all members of the broad-sclerophyllous shrub/tree element, suggest that Community 7 is a variation of Community 6 that has become degraded through too frequent burning.

Relationship of the bedrock Communities 5–7 to Campbell's (1985) scheme: by reason of their overstorey of microphyllous and nanophyllous shrubs, Communities 5 and 6 may be classified as a xeric variation of Campbell's Oukraal Oligotrophic Asteraceous Fynbos. The greater aridity in the far northern part of the Cederberg where these communities are found, and the shallower soil there, may explain the shorter, sparser overstorey compared to Campbell's Oukraal sites. Community 7 appears to represent a degraded condition of the same structural type, Oukraal, and is roughly synonymous with the subcommunity 2a described by Mustart *et al.* (1993).

Community 8 *Ischyrolepis capensis–Elytropappus rhinocerotis* Community of the Pakhuis shaleband (Figure 11)

Structural category: low mid-dense to closed small-leaved shrubland

Relevés: (13) 84, 85, 86, 87, 88, 89, 90, 91, 93, 94, 95, 142 & 144

Species richness: 29 (16–43)

Species group (Appendix 2): 0

Vegetation: mature, total cover 73–99%; one or two strata, the upper sparse to open leptosclerophyllous or proteoid shrubs to 2 m, the lower mid-dense or closed to 1 m, with leptosclerophyllous-spinescent and cupressoid-leaved shrubs and graminoid-restioid herbaceous plants; or if a single stratum, all forms excluding proteoid, to 1 m. The large number of diagnostic species, most of which are exclusive (sensu Braun-Blanquet 1932), are shown in Appendix 2. Species preferential to this community (Braun-Blanquet 1932) are the restioid *Ischyrolepis capensis*, the grass *Lasiochloa longifolia* and the small-leaved shrub *Agathosma capensis* in the lower layer and *Dodonaea angustifolia* usually in the upper layer.

Dominants: first and foremost the exclusive diagnostic and very characteristic *Elytropappus rhinocerotis*—the grey, cupressoid-leaved 'renosterbos'—as well as *Metalasia densa* (spinescent leptosclerophyllous), *Helichrysum dasyanthum* (lepto-orthophyllous) and, on two sandy transitional relevés, the tall restioid *Willdenowia incurvata*.

Locality and environment: strictly confined to the shaleband traversed by Pakhuis Pass and its outlier to the south at Groenberg; on the step, 'trap' or inclined ledge of the detrital (upper pediment) slope (4.1) or the steeper talus slope (4.2) or, in the case of relevé 93, the convexo-concave slope (5.2) near the base of the mountain; altitude 860–1 000 m, sloping 6°–28° on aspects predominantly west through south to east; confined to the Cedarberg Formation (C1S2G); substrate of fine yellow-brown silt with higher nutrient status than TMS soils, up to or exceeding 50 cm in depth with some surface sand, gravel and

stone above the undecomposed clayey shale; litter cover variable (1–60%), broken rock 0–10% or at most 20%. Annual rainfall 400–500 mm on the Pass, 800 mm at Groenberg in the south.

Special features: the shaleband is easily recognized because it forms a distinct break in the general slope, less steep and clothed with a vegetation of finer texture and greyer colour than most fynbos due to the strong dominance of the renosterbos, *Elytropappus rhinocerotis*. Other features of the community are the large suite of species exclusive to it (already mentioned) and the high cover and diversity of the graminoid element. The latter accords with Campbell's (1986b) findings that grass cover is high on the finer-textured soils. The grasses in the Pakhuis renosterveld are quite frequently grazed, probably by rodents as well as small antelope.

Relationship of the Pakhuis shaleband Community 8 to Campbell's (1985) scheme: two relevés (89 and 93) with more than 50% cover of *Elytropappus rhinocerotis* are possibly Renoster Shrubland, and a further three on dry sites at low altitude, where *Protea arborea* is lacking, may be Clanwilliam Karroid Shrubland. The remaining eight relevés, having *P. arborea* within or near their boundaries, conform closely to Campbell's Gydo Talus Asteraceous Fynbos, a type occurring on fine-textured soil. Despite its uncertain structural identity, Community 8 is clearly a cohesive, well-defined floristic unit in view of its very strong suite of 16 exclusive species. Moreover, it is confined to a distinctive habitat which, in practical terms, would be a single management unit.

Community 9 *Protea laurifolia–Euryops speciosissimus* Community on the Welbedacht footslopes

Structural category: tall mid-dense proteoid shrubland with a mid-high, mid-dense shrub understorey
Relevés: (3) 26, 31 & 32
Species richness: 31 (28–33)
Species group (Appendix 2): nil

Vegetation: young-mature to senescent; relevé 31, considered mature and typical, has 95% total cover in three strata, the upper 2–4 m tall, proteoid, the middle 1.0–1.5 m narrow-sclerophyllous shrubs, the lower less than 0.5 m of graminoids, restioids, sedges and low nanosclerophyllous shrubs.

Dominants: *Protea laurifolia* in the upper stratum, *Phylica rigidifolia* and *Cliffortia ruscifolia* in the middle, *Ischyrolepis gaudichaudiana* in the lower. This community has no differentials but species with high presence include *Euryops speciosissimus, Eriocephalus africanus, Oedera squarrosa* and *Gnidia geminiflora.*

Locality and environment: limited in the present survey to the lower pedimcnt slopes (6) of the Welbedacht escarpment at an altitude of 920–950 m, sloping gently W to SW on Peninsula Formation (C1Q1); substrate about 20 cm decp of mcdium fine reddish brown sand with pcbbles and stones, sometimes with small patches of exposed bedrock; rock cover 5–25%; litter cover 85% but less in the younger vegetation. Annual rainfall ± 650 mm.

Special features: this is one of the few communities within the State Forest that show signs of biotic disturbance. Baboons have broken protea branches to reach the edible seeds and insects within the flower heads; proteas are still being felled for firewood; and local senescence that is a feature of these footslopes may be the result of patchy burning in the past.

This tall proteoid community is rare within the Mountain Catchment Area but more common in comparable habitats outside it. This may be partly due to the fact that the habitat itself is more widespread on the drier plains and slopes outside the MCA, but it is also likely that the repeated management burns in the State Forest have hitherto been carried out predominantly in winter or spring, thus reducing the tall proteoid seedling recruitment within the reserve (Van Wilgen & Viviers 1985).

Relationship of the Protea laurifolia *Community 9 to Campbell's (1985) scheme*: Campbell records only two types of Proteoid Fynbos from the northwestern mountains, Weltevrede and Hawequas Dry Proteoid Fynbos, and Community 9 agrees most closely with the Hawequas type. It seems likely that some stands of *P. laurifolia* mentioned in 'Special features' (above) as being more common outside the catchment, could belong to the Weltvrede type, for example in the Eselbank area where there is more shale.

Community 10 *Ischyrolepis sieberi–Dolichothrix ericoides* Community on bedrock summit plateaux above 1 200 m altitude

Structural category: low mid-dense restioid shrubland
Relevés: (3) 50, 52 & 148
Species richness: 19 (17–20)
Species group (Appendix 2): R

Vegetation: mature with only 50–65% total cover; single stratum 0.5.–0.8 m of dominant restioids with narrow-sclerophyllous shrubs and succulents; occasionally with sparse emergent shrubs to 1.5. m.

Dominants: *Ischyrolepis sieberi* in all three relevés, *I. curviramis* in two, *I. virgea* in one.

Among the differential species the succulent form predominates: *Mesem 11672* is exclusive to the community, *Lampranthus lunulatus* and *Senecio crassulifolius* are preferential, being present also in the lower bedrock communities, Communities 5 and 6. *Dolichothrix ericoides* (= *Helichrysum ericoides*) is an easily recognizable wiry, cupressoid-leaved subshrub growing in cracks of bare rock outcrops. The only constantly present shrub (weakly preferential) is *Oedera sedifolia* which, again, is present in the lower bedrock communities. Crustose lichens are abundant at high altitude.

FIGURE 12.—*Stoebe aethiopica–Widdringtonia cedarbergensis* Community (No. 11) above Donkerkloof, Welbedacht, ± 1 400 m. In this woodland variation middle stratum of mid-high shrubs lacking. Standing erect against rock to right of figure is a sawn cedar plank rejected by woodcutters of earlier times.

Locality and environment: occurs from Krakadou northwards on level bedrock summit plateaux (1.2) from 1 200–1 700 m in altitude; Peninsula Formation (C1Q1) with, at most, 10 cm of coarse sand and gravel over bedrock with cover of 40–95%; 10–20% litter cover. Annual rainfall 800–1 400 mm—the latter on Krakadou summit at 1 700 m altitude.

Special features: though variable in composition this community shows some floristic affinity and habitat similarity with the lower bedrock communities 5, 6 and 7. At its lower altitudinal range on the Groenberg plateau it is within the habitat of the cedar community (11) and relevé 52 contains a stunted cedar 1.5 m tall. Since the community is undersampled, it is difficult to generalize about its characteristic features.

Community 11 *Stoebe aethiopica–Widdringtonia cedarbergensis* Community of the upper mid-rock slopes ('sederveld' or cedar woodland: Figures 12, 13 and Frontispiece)

Structural category: open woodland with mid-dense restioid understorey; or low to mid-high, mid-dense restioid shrubland.
Relevés: (20) 33, 37, 38, 39, 40, 41, 47, 101, 103, 107, 111, 112, 113, 116, 119, 125, 137, 152, 177 & 178.
Species richness: (24) 16–37
Species group (Appendix 2): S

Vegetation: mainly mature; cover (45)–55–85%. The best-developed woodland has three strata, the upper of the cupressoid-leaved tree *Widdringtonia cedarbergensis* to 8 m, the middle of mid-high shrubs and restioids 1–2 m, the lower of hemicrytophytes, predominantly restioid, 0.5–1.0 m. The shrubland has two strata, sometimes scarcely distinguishable, similar to the middle and lower strata of the woodland.

Dominants: the differential *W. cedarbergensis* in the tree layer when present, *Passerina glomerata* occasionally in the shrub layer, and *Ischyrolepis ocreata, I. sieberi* and *I. gaudichaudiana* in the ground layer. Most relevés contain one or both of the foremost differentials, *W. cedarbergensis* and *Stoebe aethiopica*.

FIGURE 13.—A grove of cedars (Community No. 11) on edge of Welbedacht Shaleband. Shrubland in foreground, with *Ischyrolepis virgea* and *Protea acuminata*, is part of the shale community (No. 17).

FIGURE 14.—*Ischyrolepis sieberi–Passerina glomerata* Community (No. 12) on the Groenberg plateau at 1 350 m, relevé 63, with *Ischyrolepis virgea* and *Cannomois parviflora* dominant; young *Protea magnifica* plants conspicuous.

Locality and environment: occurs chiefly in the Welbedacht area, decreasing northwards to the Pakhuis Mountains, in broken rocky country, on local ledges (1.2) or upper pediment slopes (4.1) above the steep cliff zone, at altitudes usually between 1 000 and 1 500 m. All aspects on slopes from level to 40° (mainly 0°–20°) on both Peninsula (C1Q1) and in the north above the shaleband on Nardouw (C1Q2) Formations, on a substrate of coarse sand, gravel and stones over bedrock. Rock cover 8–99% but usually less than 50%; litter 5–45% but usually less than 15%. Annual rainfall from 500 mm at low altitudes to 1 400 mm at the highest.

Special features: floristically this is a variable and weakly cohesive assemblage of relevés which is difficult to characterize because neither the dominants nor the differentials are strongly present. The woodland is of course easy to recognize by the presence of the cedar tree. Attempts to segregate the non-cedar relevés as a distinct community proved unsatisfactory. The total assemblage can best be defined by environmental parameters: it is the habitat within an altitudinal range of 1 000 to 1 500 m which does or could support the cedar. In past times this useful tree has been rapaciously felled, and increasingly frequent wildfires have decimated the natural regeneration. Much of the restioid shrubland in this upper mid-mountain zone may be degraded woodland from which the cedars have been removed. Also, at upper limits of its habitat the cedar is so naturally scarce that few relevés at high altitudes contain it.

Community 12 *Ischyrolepis sieberi–Passerina glomerata* Community of Groenberg Plateau (Figure 14)

Structural category: low closed restioid shrubland
Relevés: (4) 57, 58, 62 & 63
Species richness: (22) 20–28
Species group (Appendix 2): nil

Vegetation: mature; cover (50)–90–95%; single stratum to 0.9 m of mainly restioid hemicryptophytes with leptosclerophyllous and cupressoid-leaved shrubs, occasionally with open proteoids (*Protea magnifica*).

Dominants: only the restioids *Cannomois parviflora, Ischyrolepis sieberi, I. virgea* and *Restio filiformis*, and locally the widespread shrub *Stoebe plumosa*. There are no differentials and the only species with 100% presence, besides some of the dominants, are the common ubiquists of mountain fynbos, *Metalasia densa* and *Cliffortia ruscifolia*. *Pteronia camphorata*, with 75% presence but low cover, is more constant in this community than in any other.

Locality and environment: this community is limited to one locality, the broad table-top of the mountain block north of Krakadou which I have called the Groenberg plateau. It occurs on local level terraces, platforms and ledges (1.2) of the Peninsula Formation (C1Q1) on the top of this plateau (1 260–1 360 m in altitude), in coarse white sand with some surface pebbles, stones and rock over sheet or broken rock at a depth of 10–20 cm. Surface rock cover varies from 0 to 95%, litter cover from 5 to 50%. Annual rainfall 800 mm.

Special features: like the foregoing, this is a variable and poorly defined community. Its logical position in Figure 5 and Appendix 2, adjacent to the cedar community, as well as its habitat at the upper limit of the cedar zone on this plateau, indicates that it is a depauperate form of the cedar community. In floristics and habitat, however, it also shows some affinity with the high-altitude bedrock community 10 on the one hand, and those of level sandy flats (Communities 17–19) on the other. In short, it represents a complex transitional situation.

Relationship of the cedar group Communities 10–12 to Campbell's (1985) scheme: attempts to identify the structural category of the cedar community (11) with my inade-

quate structural data point to three possible types in Campbell's system: Winterhoek Dry Restioid Fynbos, Algeria Oligotrophic Asteraceous Fynbos and Wuppertal Oligotrophic Asteraceous Fynbos. The latter, having Ericaceae as well as Proteaceae present, seems the most appropriate fit. Campbell, interestingly, made no mention of a cedar woodland in his description of the Wuppertal type or any other category in his classification, implying, perhaps, that the understorey was all-important for structural classification and the cedar overstorey was irrelevant. In my floristic classification I reached the same conclusion with the finding that the non-cedar relevés could not be segregated as a separate community.

Communities 10 and 12 seem closer to each other than either of them is to Community 11. In addition to the common restioids and leptophyllous shrubs, Community 10, on a shallow, stony substrate, has some low succulent components whereas in Community 12, on deeper soil, two seed-regenerating proteoids (*P. magnifica* and *P. repens*) occur. In Campbell's scheme both communities are Restioid Fynbos. Community 12, with proteoids, is likely to be Winterhoek Dry Restioid Fynbos, and in view of other structural features that are common to Communities 10 and 12, both may well be different phases of the same structural type.

1.2 **Colluvial rock slopes** (Communities 13–15)

Community 13 *Protea nitida–Cliffortia hexandra* community on Nardouw talus slopes (Nardouw Waboomveld: Figure 15)

Structural category: low closed restioid shrubland with a tall open proteoid overstorey
Relevés: (3) 129, 131 & 132
Species richness: 53 (51–56)
Species group (Appendix 2): U

Vegetation: young-mature after a burn some seven years before; cover 90–95%; two strata, the upper an overstorey (3.5 m) of the tall proteoid *Protea nitida* and occasionally *Leucadendron rubrum*, the lower stratum (0.7–0.9 m) dominated by restioids but containing a rich variety of shrubs and herbs of many forms. Occasionally there is an intermediate stratum of ericoid shrubs ± 1.0–1.5 m tall. Floristically this is the richest community recorded in the northern Cederberg.

Dominants: only *Protea nitida* in the overstorey, *Ischyrolepis gaudichaudiana* in the lower layer.

Locality and environment: this local variation of waboomveld has only been recorded on the Nardouw Formation (C1Q2) north of Pakhuis Pass. The three relevés were taken at the base of the highest peaks, Ribboksberg and Pakhuis Peak, at an altitude of about 980 m on steepish (25°) talus slopes (4.2) with a southwesterly aspect. The substrate is a fine loamy sand with gravel, stones and large colluvial boulders, with a measurable depth of 35 to 50 cm but probably deeper in places, well drained but comparatively moister than most slopes in the area; rock cover 90 to 98% but litter less than 10%. Annual rainfall 500 mm. Outliers of waboomveld further along this range and along the lower range above the shaleband are no doubt the same community but need to be sampled.

Special features: the remarkably species-rich Nardouw waboomweld, physiognomically so similar to Community 14, differs floristically from it by the large number of its almost exclusive differentials and the complete absence of the differentials of Community 14. More sampling is needed in Community 13 to determine its extent and its exact relationship to Community 14.

Community 14 *Protea nitida–Cheilanthes induta* Community on Peninsula talus slopes (Peninsula Waboomveld)

FIGURE 15.—*Protea nitida–Cliffortia hexandra* Community (No. 13) on a Nardouw talus slope at foot of Pakhuis Peak at 980 m. *P. nitida* forms the open overstorey; *Ischyrolepis gaudichaudiana* dominant in lower stratum. Relevé 131, with 56 spp., is the richest recorded in the survey.

Structural category: low mid-dense restioid shrubland with a tall sparse proteoid overstorey
Relevés: (15) 22, 24, 25, 27, 28, 29, 34, 35, 43, 46, 49, 54, 145, 146 & 154.
Species richness: 37 (27–47)
Species group (Appendix 2): V

Vegetation: mostly young-mature (approximately 7–10 years post-burn); cover usually 45–90%. There are two strata. Sometimes *Protea nitida* appears in the upper stratum together with the mid-high to tall shrubs *Lobostemon glaucophyllus* frequent, *Hypocalyptus sophoroides, Cliffortia ruscifolia* and a few others local or occasional, but in half the relevés *P. nitida* occurs alone in a sparse overstorey 2–6 m tall. The lower, densest stratum, less than 1 m, contains restioids (principally *Ischyrolepis gaudichaudiana*), grasses (e.g. *Ehrharta calycina/villosa, E. ramosa*), the sedge *Ficinia nigrescens* and a large variety of shrubs including *Clutia alaternoides* and *Stoebe plumosa* with 100% presence, and some less common plants with larger fleshy leaves, e.g. *Pelargonium laevigatum* and the summer-deciduous *Montinia caryophyllacea. Rhus rosmarinifolia*, a low woody shrub that is a frequent component of proteoid fynbos in the southwestern mountains, is rare in this community. The semiscandent woody shrub *Protasparagus compactus* is differential for the two Cederberg waboomveld communities (13 & 14) and has high presence in both.

Dominants: *Ischyrolepis gaudichaudiana* constant and usually dominant in the lower layer, occasionally *I. sieberi*, *Elytropappus adpressus* and *Stoebe plumosa* either codominant with or replacing it. *Protea nitida*, though conspicuous in the upper layer, is not dominant except very locally where it affects community composition beneath large individuals.

Locality and environment: sixty percent of the relevés are in the Welbedacht area, on fairly uniform slopes of the colluvial boulder zone below the shaleband and the broken line of krantzes where the cedars grow. The remainder of the relevés are on slopes above Heuningvlei, with two outliers further north, one on either side of the Groenberg plateau. The community is confined to the Peninsula sandstone (C1Q1) talus (4.2) or occasionally the detrital slope (4.1), moderate to steep (16°–30°) with predominantly SW to SE aspects at altitudes of 1 000–1 200 m (the two northern outliers at 700 m and 870 m respectively). The soil, 10–40 cm deep, is generally a light grey or buff fine sand with angular quartz pebbles on the surface, darker grey and humic below, with many stones and scattered large boulders; rock cover 20–90% (average 50%), litter 3–30%. Annual rainfall 600–900 mm (average 760 mm).

Special features: black termite mounds 0.4–0.5 m tall are quite common in this community. Appendix 2 and the foregoing descriptions show that the two waboomveld communities are closely related.

Relationship of the Waboomveld Communities 13 & 14 to Campbell's (1985) scheme: since both Waboomveld Communities have an overstorey of *Protea nitida*, they fall readily into Campbell's Talus Asteraceous Fynbos. Community 13 (Nardouw Waboomveld) shows greatest resemblance to Campbell's Brandwag Talus Asteraceous Fynbos. The high restioid cover, the presence of *Leucadendron rubrum* and the large suite of understorey species (many of them listed by Campbell) indicate the strong similarity.

Community 14 (Peninsula Waboomveld) probably equates with Uitkyk Talus Asteraceous Fynbos by reason of the taller restioids, the presence of ferns, the less diverse understorey and the more mesic habitat.

Community 15 *Ischyrolepis gaudichaudiana–Stoebe plumosa* Community of upper colluvial slopes (Figure 16)

Structural category: low mid-dense restioid shrubland
Relevés: (4) 102, 104, 164 & 168
Species richness: 18 (14–19)
Species group (Appendix 2): nil

Vegetation: mature (except for relevé 164: ± five years post-burn); total cover 60–85%; one stratum, up to 1 m tall, the restioids contributing more cover than the shrubs which are also lower in stature. The restioids, except for *Ischyrolepis gaudichaudiana*, are tufted, stout and erect, the shrubs small-leaved or cupressoid. The hemicryptophytes include a few sedges (*Ficinia, Tetraria*) and grasses (*Ehrharta ramosa*). Proteoids absent.

Dominants: the restioids *Cannomois parviflora, Ischyrolepis sieberi* and *Hypodiscus laevigatus* are locally dominant; the shrub *Stoebe plumosa* regularly codominant.

Locality and environment: relevés were concentrated on the talus slopes (4.2) of Groot and Middel-Krakadou Peaks abutting the Groothoek Plateau above Heuningvlei at 1 150–1 250 m; aspect E, slope generally 25° (except relevé 104, NNW, 8°); Peninsula Formation (C1Q1) substrate of white to grey shallow sand (10 cm deep or less) with pebbles, very many stones and scattered large emergent boulders which reduce the total vegetation cover; rock cover 60–98%, usually over 90%, litter cover 0–25%. Annual rainfall 800–1 100 mm.

Special features: in floristics and habitat this community is evidently a transition on the gradient from the colluvial mid-slopes to the high summits. The soil on these slopes near the upper limit of colluvial debris is too shallow to support the rich association of species in the waboom communities, and the increased altitude contributes to a harsher climate, so that by reason of its decreased species richness this community is coming to resemble the species-poor restioid community of the highest altitudes.

FIGURE 16.—*Ischyrolepis gaudichaudiana–Stoebe plumosa* Community (No. 15) on upper colluvial slopes of Middel-Krakadou at 1 200 m, relevé 102. *Hypodiscus laevigatus* is dominant restioid; grey cupressoid-leaved shrub is *Stoebe plumosa*.

1.3 **High-altitude rock slopes** (Community 16)

Community 16 *Ehrharta ramosa–Tetraria triangularis* Community on high-altitude rock slopes

Structural category: mid-dense restioland with low sparse shrubs
Relevés: (5) 45, 147, 162, 166 & 169
Species richness: 8 (7–10)
Species group (Appendix 2): AD

Vegetation: mature; average cover 68% (48–85%); one stratum up to 1 m tall, predominantly hemicryptophytic, the restioids dominating, the shrubs contributing not more than 25% cover. The restioids are stout and tufted, the shrubs narrow-leaved, usually of lower stature and inconspicuous except for the occasional occurrence of *Protea magnifica*, a high-altitude mesophyll.

Dominants: the restioids *Ischyrolepis sieberi, I. virgea* and *Cannomois parviflora*, usually one species dominating each relevé.

Locality and environment: this community has been recorded on the Krakadou range and its extension southward as far as Crevasse Peak; it probably occurs further south but the 1985 fire prevented sampling there. It is most often found on the waxing slope (3.2) near the summit ridge on the eastern side of the range, except for the rather atypical relevé 169 on the small flat subsummit plateau (1.2) of Middle Krakadou peak. Altitude is 1 600–1 700 m, aspect N to E, slope 0°–35°, generally about 20°; on Peninsula Formation (C1Q1), the substrate of shallow (less than 15 cm) coarse sand and/or angular quartz fragments with scattered surface stone or broken rock, sometimes massive blocks on bedrock. Rock cover 60–90% except for the sandy rock-free relevé 169; litter cover 15–35%. Annual rainfall 1 200–1 400 mm.

Special features: this community has the lowest number of species of any on the well-drained sites—8 spp./100 m^2. When other factors are not limiting, there is a decrease in the number of species on the gradient from low to high altitude. In the increasingly extreme environment as one ascends, species with narrower tolerances drop out, leaving the hardy species which may become sporadic in occurrence. The few specialized species that are added to the vegetation at high altitudes are local or rare and seldom compensate for the loss in richness. For this reason it is difficult to find constant diagnostic species for high-altitude communities. Both the diagnostics of Community 16 are specialists that demonstrate this phenomenon: they are exclusive to the community but occur with low presence. *Tetraria triangularis* is fairly widespread in high-altitude and/or high-rainfall mountain fynbos but is not common. *Agathosma stilbeoides* is endemic to the Cederberg where it is confined to the uppermost rocky slopes.

2. **Sandy habitats** (Communities 17–19)

Community 17 *Elytropappus adpressus–Leucadendron glaberrimum* Community of the Welbedacht shale-band (Figures 17 & 18)

Structural category: low closed restioid shrubland with or without a mid-high shrub overstorey
Relevés: (13) 30, 42, 108, 109, 110, 114, 115, 117, 118, 120, 121, 122 & 123.
Species richness: 24 (12–36)
Species group (Appendix 2): AF

Vegetation: mature, occasionally young-mature; cover 70–99% (average 91%); structure variable. Strata basically two but sometimes there is an additional overstorey or, less often, only the lower stratum is present. The overstorey, present in 40% of the relevés, consists of either

FIGURE 17.—*Elytropappus adpressus–Leucadendron glaberrimum* Community (No. 17) on Welbedacht shaleband below Corridor Peak at 1 350 m, relevé 30. *Protea acuminata* dominant in overstorey. Note the talus from Nardouw cliffs above and bare lower edge of shaleband in foreground.

mid-high open or sparse proteoid shrubs (*Protea acuminata, Leucadendron pubescens, L. dubium*) or the emergent restioid *Cannomois virgata* in relevé 121. The upper stratum is sparse or open, seldom exceeds 1 m in height, and has a mixture of hemicryptophytes and shrubs, the latter predominant, comprising proteoid (*Leucadendron glaberrimum*) and narrow-leaved forms (*Athanasia microphylla*) or stiffly tufted restioids, e.g. *Cannomois aristata* and *Ischyrolepis virgea*. The lower stratum does not exceed 50 cm in height. Where it is closed it is strongly represented by restioids; where mid-dense, by the cupressoid-leaved shrub *Elytropappus adpressus*.

Dominants: among the shrubs are *E. adpressus* (fully constant but not exclusive), *Protea acuminata* and *Leucadendron glaberrimum* (proteoid), *Aspalathus triquetra* and *Metalasia densa* (leptosclerophyll). Usually only one of these assumes dominance in each relevé. Dominant restioids, mainly in the lower stratum, are *Ischyrolepis unispicata* (creeping and rhizomatous), *Cannomois parviflora* and *Ischyrolepis virgea* (tufted), *Willdenowia arescens* and *Calopsis viminea*. In the few cases where only the lower closed restioid stratum is present, the structural category is closed restioland.

Locality and environment: this community was sampled along the shaleband from Sneeukop to Wolfberg, above the farms Welbedacht and Driehoek. Here the shaleband (Cedarberg Formation, C1S2G), a gently inclined ledge of the upper pediment slope (4.1), is sandwiched between the precipitous cliffs and steep talus of the Nardouw Sandstone above and the broken slopes of the Peninsula Sandstone below (Figure 18). The ten relevés on this formation are at about 1 200–1 500 m altitude on gentle S to SW slopes of 0°–10°. The remaining relevés (42, 117 and 123) are at 1 030–1 130 m altitude with similar aspect and slope on Peninsula formation (C1Q1) 'sandflats islands' and during the sampling were presumed to belong to the sand-

FIGURE 18.—General view of step-like Welbedacht shaleband (Community 17). Grasses predominate in the lighter vegetation above the track at 3 years post-burn. Broken rocky fall-away below shaleband marks upper level of cedar community (No. 11).

FIGURE 19.—*Willdenowia arescens–Thamnochortus platypteris* Community (No. 18) on a sandy flat near Heuningvlei at 1 000 m, relevé 156. *Thamnochortus platypteris* is the dominant restioid; white-flowered shrub in foreground is *Metalasia agathosmoides*.

flats (Community 18). The soil generally is a fine silty pinkish to yellow sand, darker beneath, 15 cm to over 50 cm deep, with surface gravel and stones from the sandstone cliffs above; lacking organic material; litter cover 7–40%, usually 5–15%; rock cover 0–90% (average 18% but in 70% of the relevés 0–5%) mostly consisting of surface stone, the highest rock cover being on relevés close to the Nardouw Sandstone cliffs or outcrops. Annual rainfall 600–1 100 mm (average 923 mm but in 70% of the relevés 900–1 100 mm). The community appears to be more grazed and foraged than any other in the northern Cederberg: donkeys, klipbok, porcupines, grysbok, baboons, rodents and termites were noted.

Special features: structurally this community is by no means uniform, varying from a two-layered restioid shrubland with overstorey to a unistratal restioland with few shrubs resembling the structure of the restioid sandflats, Community 18. The local nature of the dominants and their diversity in form increases the impression of heterogeneity. On the other hand, floristic homogeneity is shown by the strongly differential nature of the diagnostic species, though only *Leucadendron glaberrimum* and *Athanasia microphylla* occur with reasonably high presence. *Elytropappus adpressus*, very characteristic and 100% present, is not diagnostic because it is also found in the waboom and cedar communities. Until now this species has been assumed to be conspecific with the renosterbos of the Pakhuis shaleband, *E. rhinocerotis*. *Willdenowia stokoei*, uncommon in the northern Cederberg, occurs infrequently in this community.

The Welbedacht shaleband community occurs on fertile soil with high rainfall and probably retains good subsurface moisture during the dry season by reason of an underlying deep bedrock of sandstone. Perhaps on account of these factors and the abundance of grasses in the early post-burn stage (Figure 18), this shaleband vegetation has a denser plant cover and higher faunal utilization than most other well-drained fynbos communities in the northern Cederberg.

Relationship of the Welbedacht shaleband Community 17 to Campbell's (1985) scheme: despite its uniform physiography, the Welbedacht shaleband below the peaks of Sneeukop, Langberg, Tafelberg and Wolfberg bears a complex pattern of vegetation. Nevertheless, all the relevés on this shaleband, and three on a narrower but similar band below it, sorted naturally into one homogeneous unit, Community 17.

Campbell also worked here and named his Langberg Azonal Restioid Fynbos after this shaleband. But only two of the 13 relevés in Community 17 (those with mat proteoids and over 10% grass cover) key to the Langberg type. Most of the others fit uncomfortably into either Winterhoek Dry Restioid (with *Elytropappus* and seed-regenerating proteoids) or Wolfberg Azonal Restioid (*Elytropappus* without proteoids). Campbell also acknowledged this complexity with the observation (p.78) that 'where there is much colluvial material the vegetation may be Dry Restioid Fynbos, but the most common type of shaleband vegetation of the interior mountains is Langberg Azonal Restioid Fynbos.'

This, like the Pakhuis shaleband (Community 8), is another example of a diversity of structural units in one well-defined floristic community which, on account of its physiographic uniformity, would form a single management unit.

Community 18 *Willdenowia arescens–Thamnochortus platypteris* Community of local sandy flats ('sandflats Community': Figure 19)

Structural category: closed restioland with a low shrub understorey, with or without a mid-high shrub overstorey or emergents.

Relevés: (23) 1, 2, 14, 15, 16, 18, 19, 66, 76, 77, 78, 81, 82, 99, 126, 133, 134, 136, 139, 143, 156, 171 & 172
Species richness: 22 (16–37)
Species group (Appendix 2): AI

Vegetation: young, mature or senescent; cover 55–97% (average 81%), in general a single stratum up to 1 m in height comprising hemicryptophytes and shrubs, sometimes distinguished as a dominant restioid layer with an understorey of 200–400 mm shrubs. There may be a mid-high open shrub overstorey or sparse emergents to 2 m which increase in density with post-burn age. The hemicryptophytes of the main stratum are mainly restioid, typically *Thamnochortus platypteris, Ischyrolepis monanthos* and *Willdenowia arescens*; however, the sedges *Tetraria compar, T. nigrovaginata* and *Ficinia bulbosa* are common, the grasses *Cymbopogon marginatus* and *Merxmuellera stricta* less frequent and *Stipagrostis zeyheri* rare. The shrubs of the main stratum are usually lower in stature than the hemicryptophytes and of varied form, e.g. leptosclerophyllous (*Metalasia agathosmoides, Stoebe leucocephala, Macrostylis tenuis/decipiens*), low-spreading fleshy-nanophyllous (*Rafnia diffusa*), leaf-succulent with woody stem (*Lampranthus laetus*), creeping proteoid (*Protea acaulos*) and chamaephyte (*Pelargonium coronopifolium*). Overstorey or emergent shrubs 1–2 m high include the sclerophylls *Cliffortia ruscifolia, Anthospermum aethiopicum, Athanasia oligophylla*, proteoids *Leucadendron salignum* and *L. loranthifolium*, and locally the fleshy broad-microphyllous *Othonna parviflora*.

Dominants: restioids *Ischyrolepis monanthos, Thamnochortus platypteris, Willdenowia arescens, W. incurvata, Ischyrolepis sieberi, Cannomois parviflora* and rarely *Hypodiscus neesii*; among the shrubs *Rafnia diffusa, Metalasia agathosmoides*, rarely *Cliffortia ruscifolia* and *Diosma meyeriana*.

Locality and enviromnent: local sandflats are found most frequently in the broken country south of Pakhuis Pass from Klein Kliphuis to the top of the pass and in the north between the peaks of the Pakhuis range (Figure 3). They occur less frequently on the eastern slopes skirting the Groenberg plateau and the Krakadou range. These local flat plains (2.1) give the appearance of *terraces* where they are surrounded by low rock outcrops or ridges, as in the broken terrain south of Pakhuis Pass, or of *corridors* between high cliffs in the northern and southern ranges. They occur on sandstones both of the Nardouw (C1Q2) and Peninsula (C1Q1) Formations, on level or gently inclined sites (0°–6°) mainly N to ENE in aspect at altitudes of 700–1 100 m. The substrate is white sand, at many sites estimated to be more than 1 m deep and very well drained, sometimes with quartz pebbles or fragments but no surface rock and seldom more than 25% litter cover. Annual rainfall 400–800 mm (average 565 mm). The high restioid cover may account for the frequent presence of rodents and termites, both of which apparently clip the restioid stems into neat short pieces. Other fauna include dassie, small antelope, donkey, leopard, baboon, porcupine, aardwolf, small black ants and puffadders!

Special features: structurally this community is more uniform than the foregoing and is the most frequently encountered restioland of the well-drained habitats. The rare crucifer *Cycloptychis virgata* occurs sparingly in the drier, low-altitude sandflats (800m) along Pakhuis Pass. Community 1 of Mustart *et al.* (1993) is synonymous with my sandflats community.

Relationship of the sandflats Community 18 to Campbell's (1985) scheme: Community 18 comfortably fits the key characters and description of Fonteintjiesberg Azonal Restioid Fynbos, except that the conditions are generally less mesic and rocky than described and illustrated by Campbell. In the synonymy for Fonteintjiesberg Campbell cites 'much of Taylor's (1978) plateau communities,' with the qualification that 'the drier facies would be placed in Wolfberg'. Figure 8 in Taylor (1978) illustrates precisely the appearance and habitat of the northern Cederberg sandflats where greater aridity is to be expected. Hence, much of Community 18 would be Wolfberg Azonal Restioid Fynbos. Campbell's fig. 38, illustrating Wolfberg, depicts only one rather rare variation of my sandflats community. Figure 19 (this paper) with *Thamnochortus platypteris* dominant, shows its more usual appearance.

Community 19 *Hypodiscus neesii–Elytropappus scaber* Community on rocky slopes and gravelly flats (Figure 20)

Structural category: low mid-dense restioid shrubland with sparse emergent shrubs.
Relevés: (4) 7, 8, 64 & 65
Species richness: 30 (24–37)
Species group (Appendix 2): AN

Vegetation: mature; cover 70–90% (average 82%); one stratum to 1 m in height with sparse emergent shrubs to 2.5 m. The main stratum has a rich assortment of species, the restioids providing the highest cover (see Dominants) followed by two sedges, *Tetraria ustulata* and *T. cuspidata*. The shrubs, of the same height or lower than the hemicryptophytes, are mainly leptosclerophyllous, e.g. *Elytropappus scaber, Stoebe plumosa, Agathosma pubigera, Selago lamprocarpa* and *Struthiola ciliata*. The emergents are also sclerophyllous shrubs, either with prickly leaves (*Metalasia densa, Cliffortia ruscifolia*), soft leaves (*Anthospermum aethiopicum*), or the almost leafless semi-parasite *Thesium strictum*.

Dominants: three restioids, *Ischyrolepis sieberi, Hypodiscus neesii* and *Cannomois parviflora* form a highly constant mixture but they only become weakly dominant (cover 3) in one relevé each. None of the shrubs show clear dominance.

Locality and environment: this community has been recorded only from a small area on the eastern slopes of the Groenberg plateau around Fortyn-se-Kloof on the jeep track from Pakhuis to Heuningvlei. The relevés are on the lower or concave pediment slope (6), one on a nearly flat

plain (2.1), at altitudes of 870–980 m, the slope 2°–17°, N to NE (Figure 25); on sandstone of the Peninsula Formation; substrate of shallow yellowish brown sand or gravel 5–15 cm deep; rock and litter cover both variable (2–70% and 8–40% respectively), lowest on the plain. Annual rainfall 500–600 mm (average 550 mm).

Special features: the high species richness of this community is accounted for not by the diagnostics (there is only one, *Elytropappus scaber*) but by the high number of species it shares with other communities. This suggests a transitional status, and is reinforced by the fact that in environmental characteristics it fits but poorly into the sandy habitat group of communities (2.2). However, it cannot be placed elsewhere in Appendix 2 because it is connected by shared species both with the foregoing and the succeeding communities. It is nevertheless clearly distinguished from Community 18 by the absence of the large group of differentials for that community (species group AI) and from the succeeding communities by the absence of *Elegia filacea*. Relevé 64 on the flat plain (Figure 20) is atypical both in habitat and in structure: by the prominence of restioids and the lack of emergents it is structurally a true restioland.

Relationship of Community 19 to Campbell's (1985) scheme: lacking the differentials of Community 18, Community 19 seems to be merely a variant of the Wolfberg–Fonteintjiesberg Azonal Restioid group, occurring on slopes rather than flats, with a rocky, gravelly substrate rather than sand. Some relevés with non-ericaceous shrub cover almost equivalent to restioid cover may border on Asteraceous Fynbos, thus reinforcing the transitional status of this community.

C. FYNBOS OF POORLY DRAINED HABITATS (Communities 20–26)

The remaining seven communities in this classification (Communities 20–26, see Figure 6) are arranged along a gradient of increasing altitude and rainfall. They occur from 950–1 700 m above sea level on predominantly level sites where the poorly drained soil is moist, wet or waterlogged for at least part of the year. They lack the species in group AP that characterize communities of well-drained sites but comprise no species group that unites all seven communities. The first four communities, 20–23, are distinguished by the full presence and strong dominance of *Elegia filacea* which is differential but not exclusive to them. In the same way the last two com- munities, 25 and 26, are distinguished by the differential species *Ischyrolepis curviramis*. In Community 24, *Tetraria* sp. nov. (*T 11230*) is differential and the other two are absent. These three differentials occur with less strength in the well-drained communities (section B) but are better adapted to the periodic inundation of section C. The probable ecological relationships within and between these community groups will be discussed in the sections that follow.

A major structural feature distinguishing the well-drained from the poorly-drained communities is that the latter are all restiolands whereas the former, with the exception of Communities 16 and 18, are shrublands. I have standardized this distinction by defining shrubland as vegetation with a shrub cover exceeding 25% (B-B value 3 and over). Where the shrub cover is 5–25% (value 2) I have called it a restioland with shrubs; where shrubs are less than 5% (value 1) I consider it a pure restioland or, where appropriate, a sedgeland.

1. **Mid-altitude plateaux and terraces** (Communities 20–24)

1.1 **Winter-wet habitats** (Communities 20–23)

Elegia filacea restiolands occur on winter-wet sites between 950 and 1 350 m in altitude. Communities 20 and 21, on shallow sand over bedrock below 1 000 m, are rich in species (average 29–35 taxa for 100 m^2). The greater proportion of species are shrubs (± 60%) but the cover is predominantly restioid. Community 21 is the only community with a high rock cover and consequently a more open vegetation. Communities 22 and 23, on deeper sand at higher altitudes (1 100–1 320 m) are poorer in species (average 12–14 taxa per 100 m^2) the greater pro-

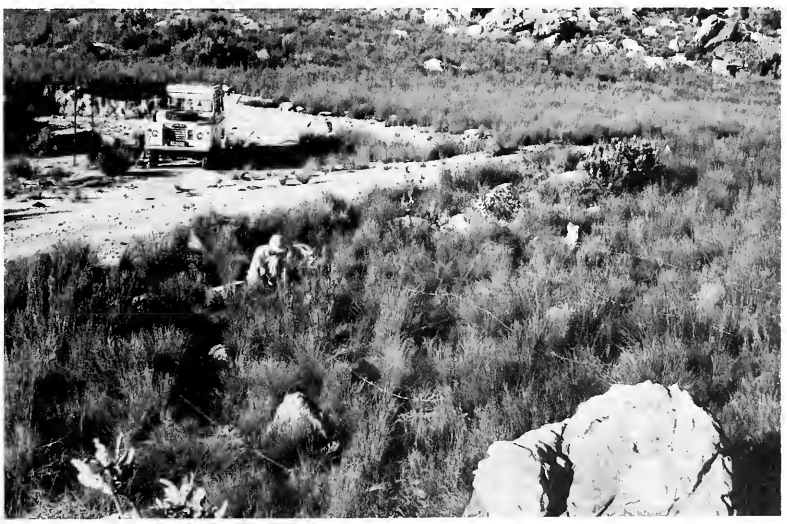


FIGURE 20.—*Hypodiscus neesii–Elytropappus scaber* Community (No. 19) on a local gravelly flat adjoining Fortyn-se-Kloof at 870 m, relevé 64. *Hypodiscus neesii* is dominant but four other restioids and four sedges are present in this relevé with 32 spp.

FIGURE 21.—*Elegia filacea–Centella* cf. *recticarpa* Community (No. 21) on a rocky ridge, the only *Elegia* restioland with a high rock cover, relevé 127.

portion of which (60–70%) are hemicryptophytes, the cover predominantly restioid. The strongest dominance of *Elegia filacea* is in Community 23 which has the lowest species richness and highest altitude of all four communities in this category.

Community 20 *Elegia filacea–Tetraria* sp. nov. (*T 11230*) *Community on shallow sand over bedrock*

Structural category: closed restioland with low sparse shrubs.
Relevés: (3) 72, 74 & 153
Species richness: 29 (26–30)
Species group (Appendix 2): nil

Vegetation: young-mature (± 7–10 years post-burn); cover 80–95% (average 89%); one stratum up to 0.7 m tall. Hemicryptophytes predominate in cover and comprise an average of 44% of the species in the relevés. Restionaceae as a family are strongly dominant, the sedges sometimes co-dominant. The shrubs are lower in stature and relatively inconspicuous but quite rich in taxa, mainly leptosclerophyllous, some spiny-leaved, e.g. *Metalasia densa*. There are no diagnostic species for this community.

Dominants: species are individually not stronger than cover 3, usually only one species per relevé: *Elegia filacea, Tetraria* sp. nov. (*T 11230*), *Cannomois parviflora, Willdenowia arescens* and *Ischyrolepis curviramis*.

Locality and environment: near Amon-se-Poort and north of Ribboksberg, on level or slightly sloping (0°–5°) local flats (2.1) with N aspect, average altitude 950 m; on Peninsula (C1Q1) or Nardouw (C1Q2) Formation; substrate yellowish, shallow (10–15 cm) silty sand with pebbles over bedrock, poorly drained, with free surface water standing after rain; no rock cover, litter negligible except in relevé 153 (20%). Annual rainfall 500–800 mm (average 666 mm).

Special features: sparse seedlings of *Protea laurifolia* on or near all three relevés suggest that in its mature condition this community has a tall proteoid overstorey or emergents.

Community 21 *Elegia filacea–Centella* cf. *recticarpa* Community on rocky terraces over bedrock (Figure 21)

Structural category: mid-dense restioland with low sparse shrubs
Relevés:(2) 127 & 128
Species richness: 35 (32–37)
Species group (Appendix 2): AU

Vegetation: young-mature (± 7 years post-burn); cover 78–80%; one stratum up to 0.6 m tall. Hemicryptophytes, especially restioids, predominate in cover and comprise 38% of the species. Shrubs are about the same height as the hemicrpytophytes, numerous in species but never dominant, mainly leptosclerophyllous in form except the diagnostic *Centella* cf. *recticarpa* which has tufted filiform leaves up to 90 mm long.

Dominants: only *Elegia filacea* with a cover of 3 or 4.

Locality and environment: on the rocky ridge running transversely between Kliphuis Peak and Ribboksberg in the Pakhuis range, on small local terraces on the plane slope (5.1) with a gentle (4°) south slope at 950 m altitude; Nardouw Formation (C1Q2). The coarse stony sandstone soil, less than 10 cm deep over bedrock, is better drained than the other *Elegia filacea* communities, with surface flow and subsurface percolation occurring after rain. Rock cover, including exposed bedrock, is very high (98%); litter cover 6–10%. Annual rainfall 500 mm.

Special features: this is the only one of the four *Elegia filacea* communities that has a high cover of exposed rock

and reasonably good drainage. As a consequence it has a more open canopy and a higher number of species, especially differential shrubs, than other communities in this group. Its relatively young post-burn age, low stature and richness in species suggest that it may be a fire sere of a taller restioid shrubland as yet unsampled.

Community 22 *Elegia filacea–Staberoha aemula* Community on deep sand on the Groothoek plateau

Structural category: closed restioland
Relevés: (3) 97, 98 & 105
Species richness: 14 (12–17)
Species group (Appendix 2): AX

Vegetation: mature; cover 90–95%; one stratum up to 0.8 m tall. Restioids provide the greatest cover and hemicryptophytes comprise, on average, 70% of the species. The restioids are nearly all tufted, some stiffly erect (e.g. *Hypodiscus laevigatus*), others more compact and cushion-shaped (*Ischyrolepis curviramis*) with shorter sedges like *Ficinia petitiana* beneath the main canopy. The few shrubs are mostly leptosclerophyllous and inconspicuous.

Dominants: *Elegia filacea* and *Staberoha aemula*; *Tetraria* sp. nov. (*T 11230*) subdominant in relevé 97.

Locality and environment: on the plateau (1.2) between Groothoek and Moedersielshoek above Heuningvlei, on the lower eastern slopes of the Krakadou range, on level sites at 1 100 m altitude; on Peninsula Formation (C1Q1). The substrate is a white sand 25 cm to over 1 m deep, occurring in situations that could become wet or even waterlogged in the rainy season; no surface rock; litter cover 10–15%. Annual rainfall 800 mm.

Special features: the whole of the Groothoek Plateau consists of deep sand, the better drained parts having been largely planted with cedars. The remaining open areas are either moister depressions and flats bearing the present community, or small mounds with the sandflats community 18; there are few transitional situations.

Community 23 *Elegia filacea–Ischyrolepis virgea* Community on sand on the Groenberg plateau (Figures 22 & 23)

Structural category: closed restioland with low sparse shrubs with or without emergent mid-high proteoid shrubs
Relevés: (3) 51, 59 & 60
Species richness: 12 (9–16)
Species group (Appendix 2): nil

Vegetation: mature; cover 95–100%; one stratum up to 0.85 m in height. Hemicryptophytes predominate in cover and comprise an average of 61% of the species. Restionaceae are frequent and strongly dominant, sedges sparse, grasses negligible. The few shrubs in the main stratum are mainly leptosclerophyllous, the emergents proteoid: *Leucadendron concavum*, endemic to sandy plateaux in the northern Cederberg, and *Protea repens* uncommon in the northwestern mountain complex (Figure 23).

Dominants: *Elegia filacea* strongly dominant in all relevés, *Cannomois parviflora* less strongly dominant in relevé 60 only.

Locality and environment: on the high-altitude Groenberg plateau (1.2) north of Krakadou, on level sites at altitude 1 240–1 320 m (average 1 273 m) on Peninsula Formation (C1Q1). Substrate is a pinkish white or yellowish sand less than 50 cm deep. There is no surface rock but quartz pebbles often cover as much as 90% of the surface. The impervious level bedrock at 15–50 cm below the surface may impede drainage to the extent that local sites could become temporarily waterlogged after heavy rain. Litter cover 8–10%. Annual rainfall 800 mm.

FIGURE 22.—*Elegia filacea–Ischyrolepis virgea* Community (No. 23) on a sandy platform at 1 260 m on Groenberg plateau, relevé 59. *Elegia filacea* strongly dominant. Quartz pebbles cover 90% of surface.

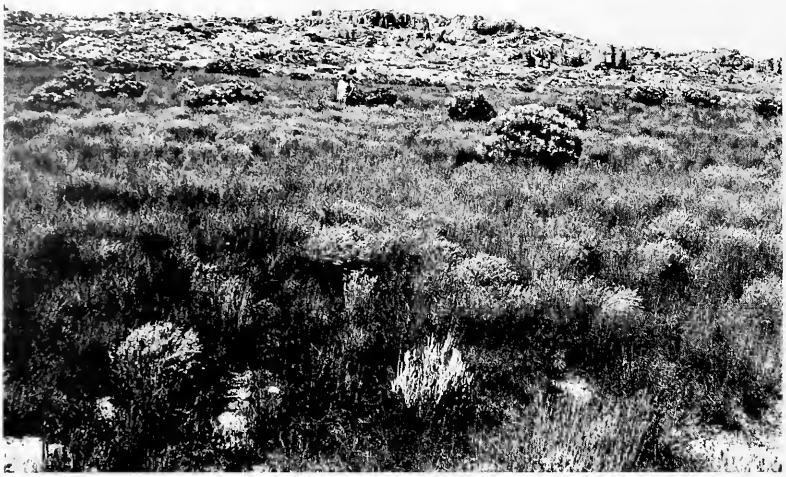


FIGURE 23.—*Elegia filacea–Ischyrolepis virgea* Community (No. 23) on Groenberg plateau, with emergent *Protea repens* to 1.5 m tall, 1 320 m, relevé 60. *Leucadendron concavum* is present but inconspicuous.

Special features: this community is distinguished from the three foregoing restiolands by the absence of the diagnostic species for Communities 21 and 22 and the presence in some instances of proteoid emergents. Because *E. filacea* is so strongly dominant and other species relatively inconspicuous, this community looks more like a single-species 'meadow', especially when the emergents are lacking, than any of the preceding *E. filacea* restiolands (Figure 22).

The local endemic *Leucadendron concavum* is listed in the Red Data Book (Hall & Veldhuis 1985) as 'vulnerable' and 'known from two populations a few kilometres apart'. These remarks refer to the accessible populations on the Pakhuis Plateau at about 900 m in altitude but I have found several smaller populations on isolated flatlands of the Groenberg plateau at altitudes above 1 200 m.

1.2 **Permanently moist habitats** (Community 24)

Community 24 *Tetraria* sp. nov. (*T 11230*)–*Elegia asperiflora* Community on seepages

Structural category: closed sedge-restioland
Relevés: (3) 73, 165 & 179
Species richness: 14 (10–19)
Species group (Appendix 2): BB

Vegetation: young-mature to mature; cover 94–100% (average 97%); one stratum up to 1 m tall. Hemicryptophytes provide by far the greater cover and comprise an average of 67% of the total number of taxa. Cyperoid (sedge) and restioid species are co-dominant. As may be expected in such a specialized habitat some species are narrowly confined to seepages, e.g. the herb *Utricularia capensis*, the sedges *Fuirena hirsuta, Chrysithrix junciformis, Epischoenus gracilis*, the juncoid *Juncus capensis*, the grass *Andropogon appendiculatus* and the dominants. Shrubs are few in number, low in stature and cover, usually leptophyllous but a few are sclerophyllous.

Dominants: *Tetraria* sp. nov. (*T 11230*), *Elegia asperiflora, Restio occultus* and *Macrochaetium ecklonii*, each tending to dominate singly and strongly on a particular site.

Locality and environment: this azonal community is thinly scattered throughout the Cederberg wherever there is seepage or at least perennially moist soil. This specialized edaphic condition is found either in high-altitude shallow stream valleys or where there is an abrupt break in a gentle slope, forming a terrace 'step' ± 1–3 m high, usually underlain by an impervious rock band which may protrude at the bottom of the step. Altitudes for the relevés vary from 930–1 570 m, aspects N or S 5°–14°, on sandstones of C1Q1 and C1Q2 Formations. Substrates are fine sand or clayey silt with a high organic content yielding a black or dark chocolate-brown deep soil with no rock cover and low litter (5%). Annual rainfall 800–1 200 mm (average 1 040 mm).

Special features: seepage communities are rare and of limited extent but of distinct appearance. They may be from 100 m^2 to a few hectares in area. The high cover and diversity of sedges is characteristic of the sedge-restio community described here. There are, however, other seepage communities that, because of their rarity, have not been sampled in this survey. One is the *Epischoenus gracilis–Restio perplexus* sedge–restio tussock at about 1 330 m on the Sneeuberg Hut plateau from which palynologists have described nearly 10 000 years of vegetation change (Meadows & Sugden 1990). There is the dense grassy tussock at Slangvlei, and a mixed seepage community near Moedersielshoek at the southern end of the Groothoek plateau where *Watsonia stokoei*, limited to the Cold Bokkeveld, Piketberg and Cederberg ranges, grows in profusion. Seepages, despite their small extent, are of greatest importance as 'sponges' for the controlled release of water to the streams and settlements below. Like estu-

aries they harbour a wealth of specialized organisms whose complex interactions need further careful study to ensure correct management of these valuable but vulnerable ecosystems.

2. **Summit platforms** (Communities 25 & 26)

These two communities are distinguished by the full presence and strong dominance of the taxon called *Ischyrolepis curviramis* in Appendix 2. A separate species, *I. nana*, has now been described for a high-altitude taxon that had generally been assumed to be conspecific with *I. curviramis* (Linder 1985). Both these closely related species occur in the Cederberg, *I. curviramis* at altitudes 'generally below 1 200 m', *I. nana* at high altitudes, 'rarely below 1000 m' (Linder 1985). Since most of my Cederberg field work was done before I was aware of the new species, I used the name *I. curviramis* for both concepts. Because it is virtually impossible to distinguish between the two species in retrospect from the key characters given by Linder (1985), I have retained the name *I. curviramis* for both species in Appendix 2. Whereas it can be safely assumed that the species occurring in Communities 25 and 26, at the highest altitudes in the northern Cederberg, is *I. nana*, the concept for the other occurrences of '*I. curviramis*' in Appendix 2 must remain mixed.

Community 25 *Ischyrolepis nana–Restio strobilifer* Community on high sandy platforms

Structural category: closed restioland
Relevés: (2) 167 & 170
Species richness: 5 (5–5)
Species group (Appendix 2): BF

Vegetation: mature; cover 90–98% (average 94%); one stratum scarcely 0.5 m tall, consisting solely of restioids and an occasional high-altitude sedge, e.g. *Epischoenus dregeanus* in relevé 170.

Dominants: *Ischyrolepis nana* with *Restio strobilifer* subdominant.

Locality and environment: upper levels of the Krakadou range below the final summit plateaux at altitude 1 550–1 600 m on almost level platforms (1.2); on Peninsula sandstone (C1Q1) with a substrate of fine grey (rather humic) or white sand up to 50 cm deep, with white quartz pebbles or fragments 1 or 2 cm in diameter scattered on the surface, moist during winter but becoming very dry in summer; no surface rock or litter but rocky beneath. Annual rainfall 1 200 mm.

Special features: this rare and local community needs further sampling to establish its status. It appears to be a variation of the summit tussock community (26) with slight amelioration of the harsh conditions prevailing there. The almost imperceptible slope of 1° or 2° would allow slow percolation of the surface water, thus effecting a less abrupt change in soil moisture status from winter-wet to summer-dry conditions. This is the most species-poor community sampled in the northern Cederberg.

Community 26 *Ischyrolepis nana–Pentaschistis densifolia* Community on flat summits ('summit tussock': Figure 24)

Structural category: closed Restioland
Relevés: (3) 150, 158 & 163
Species richness: 7 (3–12)
Species group (Appendix 2): BG

Vegetation: mature cover 70–95% (average 82%); one stratum not taller than 0.35 m. The only important perennial is the cushion-like *Ischyrolepis nana* which gives this community its distinctive appearance. The only other constant perennial is the infrequent grass *Pentaschistis densifolia*. Succulents like *Senecio crassulifolius* and the mesem *Lampranthus scaber* are sometimes present with low frequency and cover. In the vernal aspect recorded in relevé 150 in November (still the spring season on high summits) nine other therophytes, chamaephytes and geophytes were listed, including *Laurentia arabidea*, *Hypo-*

FIGURE 24.—*Ischyrolepis nana–Pentaschistis densifolia* Community (No. 26) on a high platform on Groot Krakadou at 1 700 m. Rounded tussocks of *I. nana* are distinctive.

choeris glabra (an alien), *Hesperantha radiata, Spiloxene capensis, Drosera* sp. and *Helichrysum* sp.; *Pelargonium triphyllum* was added in January.

Dominants: only *Ischyrolepis nana*, strongly dominant.

Locality and environment: all three relevés were done at different seasons on different sites on the large flat summit (1.1) of Groot Krakadou but the community is to be found on other tabletops from Pilaarsberg at 1 000 m in the north to Tafelberg at nearly 2 000 m and probably further south. It occurs on Peninsula (C1Q1) and Nardouw (C1Q2) sandstones where the substrate is a coarse sand, on the surface white or grey and darker beneath, 5–40 cm deep with about 10% litter cover, confined to isolated rock-free corridors between protruding 'whalebacks' of the bedrock that underlies the sites. Annual rainfall on Krakadou is 1 400 mm.

Special features: the rigour of the environment on these tabletop summits is perhaps unequalled anywhere on Cape mountains. The microclimate at soil level ranges from extreme heat and drought in summer to freezing conditions with snow and ice in winter. After rain, the undrained soil rapidly becomes inundated and may either remain saturated for weeks in winter or dry out rapidly and completely after a summer thunderstorm. Southeast winds may ameliorate the summer air temperatures but can excessively desiccate the vegetation since they are seldom accompanied by the moist 'tablecloth' cloud in the northern Cederberg. The effect of these conditions on the vegetation has been to eliminate all but the hardiest plants. Were it not for the ephemerals that appear in the comparatively benign spring and early summer, this community would have the lowest species richness of any in the Cederberg. Because the corridors of summit tussock are isolated from one another by huge slabs and grotesque piles of bare rock, wildfires seldom penetrate; the vegetation is usually long unburnt but does not appear to be senescent.

Relationship of the level restiolands Communities 22–26 to Campbell's (1985) scheme: the 'extremely high graminoid cover relative to shrubs' and the localized habitats, puts these five communities clearly into Campbell's Azonal Restioid Fynbos. 'Graminoid' here refers only to restioids (over 80%) and sedges (up to 20%), as the cover of true grasses is insignificant.

Communities 22 and 23 fall into the Wolfberg–Fonteintjiesberg group. Community 22 on lower drier sandy plateaux is probably 'Wolfberg'; Community 23 at higher altitude is more like 'Fonteintjiesberg' but the characteristic *Elegia filacea* 'meadowland' is not mentioned by Campbell.

Mature stands of Community 24, with the tall *Restio occultus*, have the structure described for Crystal except for the high cover of the sedge *Tetraria pleiostachys*. Communities 25 and 26 seem closest to Campbell's description of Sneeukop which, however, is not recorded in the northwest. This very distinctive 'summit tussock' vegetation, though not confined to the Cederberg, is most often found there and may well be an undescribed structural type. Although none of these local restiolands can be readily identified to Campbell's type level, they all clearly fit his Azonal Restioid subseries which, as he states, 'always occupies localized sites.'

Discussion and conclusions

Method

The 26 communities revealed by the Braun-Blanquet phytosociological analysis are arranged in a natural hierarchy of units, defined by diagnostic species combinations, that correlate well with environmental factors of the region. Thus, the planner and manager with a field knowledge of some three dozen diagnostic species could use the classification to identify the main communities and hence the habitats. Because the classification reflects the environment it must have value as a management tool. This does not imply that each community is necessarily a separate ecological management unit. It is precisely the natural hierarchy inherent in a Braun-Blanquet classification that enables the ecologically and floristically related communities to be grouped together into fewer practical management units (Van Wyk & Bredenkamp 1986). In the Cederberg, for instance, further investigation might show the following groups of communities to be suitable for amalgamation into single management units: Thicket communities 1–4; Bedrock communities 5–7; the cedar community 11 with its putative variant (12); the waboom communities 13 and 14 possibly with the upper-altitude variant (15); some of the *Elegia filacea* restiolands (20–23); and the summit tussocks (25–26).

The applicability of the Braun-Blanquet phytosociological methods to studies in southern African vegetation has been summarized inter alia by Werger (1977) and its practical application in conservation planning by Bredenkamp & Theron (1976). The opinion that this tabular synthesis of floristic data is useful in interpreting ecological factors is shared by earlier workers in mountain fynbos such as Werger *et al.* (1972), Boucher (1978), Taylor (1984a) and McDonald (1988, 1993a, b & c). A phytosociological classification may take more time than a structural classification but is more stable, precise and detailed. Fire, for instance, has a drastic effect on structure whereas floristic composition is more stable.

The floristic detail of a phytosociological table gives finer insights into the distribution and ecological requirements of species that are rare or vulnerable to specific factors of the environment; it also identifies sensitive specialized habitats by means of narrowly restricted species.

The structural classification of Campbell (1985)

Compatibility of the two systems, floristic and structural, seems greatest at the highest hierachical level. At the level of series, ten of the eighteen fynbos communities in my analysis of relationships were identified as Restioid, seven as Asteraceous and one as Proteoid Fynbos. This is entirely consistent with Campbell's regional community complexes where he recognizes (p. 112) 'a Restioid-Asteraceous Fynbos Mountain Region (comprising the North-Western, Central and Southern Interior Mountain

Regions)' which of course includes the Cederberg. At the subseries level, all the floristic communities occurring on localized, sandy, usually level sites, well drained or not, were identified as Azonal Restioid Fynbos. This is a good correlation of floristics and broad habitat features with structure. At the lowest level, the type, there is least congruence. The floristically well-defined Communities 8, 11 and 17 each contain three structural types, possibly more, yet each community occupies a physiographically homogeneous and distinct habitat which would be considered a single unit for management.

'Economy of time and effort' is said to be a major advantage of structural surveys. Yet it is doubtful whether the mass of complex structural data to be gathered and analysed in order to determine a vegetation unit at type level, would be easier or quicker than a floristic survey at community level. However, a simplified system, at the level of subseries or series, could well be quicker, easier to interpret and more effectively comparable to a floristic system.

Few of the attributes of a floristic classification are shared by a structural system. Nevertheless, the two systems can be seen as complementary. The floristic survey, which places more emphasis on presence or absence of a species (and, on that account, can encompass young vegetation as soon as post-burn seedlings or new shoots are identifiable) is most appropriate for long-term management, including the conservation of rare and endemic species.

The structural survey records mainly the amount of actual and relative cover of structural-functional forms and can be done without extensive *a priori* experience in field taxonomy. This will be more useful for monitoring in experimental and autecological studies which require a detailed record of short-term changes.

Habitat-floristic relationships within the study area

The species groups with broad amplitude reveal three major units, the first, Thicket (a variation of Acocks's Veld Type 4), the other two, Fynbos. Thicket, in terms of its floristics, structure and habitat, is clearly distinct from Fynbos, and the four thicket communities, occupying a small area of the Cederberg, are confined to riparian and mesic, fire-protected habitats. The thicket group as a whole is characterized by species group G (Appendix 2), comprising the tree *Podocarpus elongatus*, and the forest undershrub *Clutia pulchella*, both exclusive to this group but not frequent. The individual thicket communities are best recognized by their chief diagnostic species which are exclusive, fully present and often dominant, viz. *Olea europaea* subsp. *africana* in Communities 3 and 4, *Metrosideros angustifolia* in Communities 1–3, and *Brabejum stellatifolium* in Community 1. All thickets occur on sandstone of the TMS. Species richness in thickets, rather low relative to most fynbos communities in the Cederberg, is highest in Communities 3 and 4 where the substrate is moist but well drained, not phreatic.

Floristic connections of thicket with fynbos are few. Species group K (Appendix 2) comprising a tree, two shrubs and a woody climber, is shared by the Rocky streambank and Scree thicket Communities 3 and 4 and the fynbos Bedrock Communities 5 and 6; the latter, like the former, are protected from fire by areas of bare rock. A broader connection is seen in species group AC (Appendix 2) comprising forest or forest precursor species that regenerate from base or stem coppice and thus can occur, but sparingly, in certain fynbos situations, notably on colluvial slopes (Communities 13 to 15) where boulders and rocks provide added shade, moisture and protection from less severe fires.

The first subdivision of fynbos into two groups on the basis of soil drainage has already been mentioned. The larger group—Communities 5–19 on well-drained soils—is defined by the presence of species group AP (Appendix 2) which is absent in the smaller group (Communities 20–26) on poorly drained soils. In the same way the first group on well-drained soils (Community 5–19) is subdivided by presence of species group AA in Communities 5–15 on rocky slopes, and its absence in Communities 17–19 on silty, sandy and gravelly flats. In both cases the smaller group has no shared defining species, implying that these smaller groups are ecologically as well as floristically more heterogeneous than the larger groups. In Appendix 2 these groups are further subdivided by progressively more restricted floristic parameters so that the extent of relationships can be seen at a glance. In interpreting Appendix 2 it must be noted that the defining group is considered to be present if only one of the species in the group, not necessarily the 'leading' or most frequent species, is present. For example, Communities 10 and 16 are placed in the well-drained section of Appendix 2 on the presence of *Ischyrolepis sieberi* despite the absence of *Ehrharta calycina/villosa*.

Species richness in Cederberg fynbos communities, as in the thickets, is highest in the more favourable, less extreme habitats, the mid-slope Waboomveld Communities 13 and 14 with well-drained deepish colluvial soil and sufficient rainfall.

All the fynbos communities except two are on soils derived from the Table Mountain sandstones. The exceptions are the Pakhuis and Welbedacht shaleband Communities 8 and 17 on the Cederberg Formation. These are floristically distinguished from the rest, and, surprisingly, from each other, by quite a large number of diagnostic species that are exclusive to each of them. Despite this, their species richness is hardly higher than average, and they both show quite numerous higher-level floristic relationships with sandstone communities because the surface shale in both communities is admixed to some extent with sand and debris from the slopes above.

Comparison with other regions

The broad environmental groupings based primarily on soil moisture—thicket in stream Kloofs and screes, fynbos shrublands on well-drained slopes, restiolands on flats with good or impeded drainage—are found in other mountain fynbos areas such as the Kogelberg (Boucher 1978), Cape Point (Taylor 1984b), parts of Table Mountain (Glyphis *et al.* 1978; Jeffery & Wilson 1987) and Zachariashoek (Van Wilgen & Kruger 1985). They also correspond roughly to the major habitat-vegetation complexes of the Upper Orange River Valley which Werger (1980) summa-

rizes as 'riverine forest and woodland vegetation, the shrubby vegetation of the slopes and the non-shrubby vegetation of the flats.' In Cape mountains, non-shrubby restiolands are most extensive where the Table Mountain Formations are level or slightly tilted, as in the Cederberg and at Cape Point (Taylor 1984b), but are rare where flat topography is lacking as at Swartboskloof (McDonald 1988) and Orange Kloof (McKenzie *et al.* 1977). Even shrublands on slopes in the Cederberg have a strong restioid component, the shrubs, including the proteoids, being mainly leptophyllous (e.g. *Serruria*) and less conspicuous. In other mountain regions of the Cape System, shrublands dominated by tall proteoids with broad mesophyll leaves are common on the moister slopes. That such proteoid shrublands are nowhere as common in the Cederberg may be partly due to the generally more xeric conditions and partly to the biotic influences mentioned below.

Of particular interest is the high-level floristic similarity between some Cederberg communities and those of western Cape foreland vegetation. The leading species of Group AP that defines well-drained fynbos in the Cederberg (*Ehrharta calycina*) has been shown by Boucher (1987) to define the most widespread formal class of Cape foreland vegetation comprising five orders, many alliances and a host of associations in strandveld, lowland fynbos and renosterveld. Also, a smaller class of Boucher's (1987) thickets is defined by *Olea europaea* subsp. *africana* which is the leading species in group F that defines thickets of scree and sand in the Cederberg.

Biotic influences

Fortunately, the Cederberg is free of serious problems with invasive alien plants. For well over a century, however, the natural vegetation has been heavily exploited for grazing, for cedar timber and for medicinal shrubs such as buchu (*Agathosma betulina*) and bush tea (*Aspalathus linearis*). These operations have largely involved the repeated and excessive use of fire which, enhanced by the comparatively dry conditions in the northern mountains, has resulted in severe degradation of the vegetation. These practices may partly explain two features of present day Cederberg vegetation. One is the large proportion and apparent permanence of highly inflammable shrubs in genera such as *Stoebe* and *Elytropappus* which in less degraded habitats are generally regarded as post-burn pioneers. The high biomass of these shrubs in a naturally xeric type of vegetation appears to have increased the fire danger and intensity to a level where frequent wildfires of 20 000 ha in area are not uncommon. The second feature is the scarcity of tall obligate seed regenerating shrubs (Van Wilgen & Kruger 1985). *Protea repens, P. punctata, P. magnifica* and even *P. laurifolia* are not common in the Cederberg today. The three first mentioned may be naturally infrequent because they are close to their northern limit of distribution, but *P. laurifolia* extends as far as the northern extremity of the fynbos escarpment near Nieuwoudtville. In the Cederberg it is much more common outside the State Forest than in comparable habitats within it. The increased size, frequency and intensity of wildfires at present, and the deleterious winter/spring management burns in the past, may partially explain this. Present policy stipulates that management burns should be carried out during late summer when best regeneration of obligate reseeders is obtained, and that the interval between burns should exceed the youth period for these species.

In general, restiolands like the Sandflats (Community 18), where many of the subordinate plants are chamaephytes or short-lived reseeders, can and should be burnt at shorter intervals. This does not, however, apply to the high altitude Summit Tussock (Communities 25 and 26) where regeneration is slow and areas of bare rock limit natural fires.

4. Floristic analysis

Introduction

Since the preservation of species is a primary objective in the management of nature reserves, there is a need for complete inventories, especially of plants, in protected areas (Siegfried 1989). Moreover, inventories provide basic information for more detailed work on the preservation of biodiversity, the attributes of plants such as endemism, and an understanding of the dynamics of plant communities, aimed particularly at the prioritization of reserved areas and at applying appropriate management principles to them. With this in mind, and considering the phytogeographic importance of the Cederberg situated near the northwestern extremity of the Cape Floristic Region, I decided to expand my preliminary short list, drawn up as an aid to field identification, to a full floristic inventory of the whole Cederberg Wilderness and Mountain Catchment Area. Its situation and extent, and its historical and environmental setting, are described in Chapter 2.

Checklists and floristic analyses had previously been published for local areas in the better known species-rich southwestern parts of the Cape Floristic Region (Boucher 1977; Olivier 1979; Taylor 1985; McDonald & Morley 1988; Buys *et al.* 1991), and in the south and east (Fourcade 1941; Olivier 1977, 1983; Van Wyk *et al.* 1988), but no similar data were available for the lesser known northwest of the Region.

Comparison of three local floras

A floristic analysis of the Cederberg (Table 1) is followed by tabulated data (Tables 2–4) that examine and attempt to explain the differences between mountain floras in the northwestern and southwestern parts of the Cape Floristic Region (CFR). For this purpose the flora of the Cederberg was compared with two similar-sized floras (1 100–1 800 species) in the southwest, namely the Cape Hangklip area (Boucher 1977), here referred to by the symbol CHA, and the Cape of Good Hope Nature Reserve (Taylor 1985), usually referred to as Cape Point (CPT). Both the latter areas are within the cooler and wetter part of the CFR where the highest concentration of many distinctive elements of the Cape flora occurs (Cowling & Holmes 1992).

Table 2 shows that the species density of 1.4 species per km^2 in the Cederberg is far lower than the densities in southwestern mountains: 5.9 for CHA, 14.0 for CPT. Whether or not this reflects a real low species *diversity* at the alpha, beta or gamma level—or at all three—remains to be investigated by more sophisticated techniques. The Cederberg, however, despite its much larger size, does have a smaller range of habitats than the southwestern areas. It has lower extremes of total rainfall but a higher proportion of winter rain and longer periods of summer drought. It has poorer and less diverse soils—no granite, smaller and less diversified areas of shale, no coastal sands—and a simpler geological structure. The near-horizontal strata with complete lack of folding (rare in Cape orogenesis) results in taller cliffs, fewer long gentle slopes, fewer moist habitat types but larger level plains and high plateaux of shallow sand over bedrock. In short, an impoverished environment is repeated within an area much larger than those of the southwestern landscapes discussed here.

Table 2 also shows that the species-to-genus ratio in the Cederberg (4.3 species per genus) is higher than that in the southwest (3.3 for CHA, 2.8 for CPT). This suggests that the Cederberg, with larger genera, may be an important centre of local species radiation (cf. Goldblatt 1978: 384). Alternatively, or in addition, the Cederberg represents a meeting place where elements from the driest floras of the winter rainfall region in Namaqualand and the western Karoo overlap the wetter floras of the south.

Table 3 shows the extent to which the total floras of the three areas are concentrated in their ten largest families and genera. Data summarized in Table 4 show that in all three floras, and in the CFR, the five largest genera comprise about 14% and the ten largest about 20%, of total species. The congruence of these figures is reassuring evidence for the close biological relationship, not only between the three local floras but also between them and the CFR as a whole.

TABLE 1.—Analysis of the flora showing the number of each taxon and the percentage that each contributes to the total flora

	Pteridophytes		Gymnosperms		Monocotyledons		Dicotyledons		
	No.	% of total	No.	% of total	No.	% of total	No.	% of total	Total
Families	12	12.4	2	2.1	18	18.5	65	67.0	97
Genera	16	3.9	2	0.5	123	30.1	268	65.5	409
Species	25	1.4	2	0.1	519	29.2	1232	69.3	1778

TABLE 2.—Comparison of floristic and areal data for three local floras

Local flora	Fam.	Gen.	Spp.	Spp. per genus	Area (km^2)	Spp. per km^2
Cederberg (CED)	97	409	1778	4.3	1260	1.4
Cape Hangklip (CHA)	110	430	1407	3.3	240	5.9
Cape Point (CPT)	87	395	1091	2.8	78	14.0

In a similar study Hilliard & Burtt (1987) considered that the close similarity between the floras of the southern Drakensberg (23% in the ten largest genera) and the CFR (20%) 'almost certainly stems from their representing biologically coherent areas.' By contrast, statistics from very large areas with political, as opposed to biological or environmental boundaries show a different picture: in Natal Province as a whole the ten largest genera contribute only 12% to the total flora (Hilliard & Burtt 1987) and in the Cape Province as a whole, 15% (Goldblatt 1978: table 7). In large regions with boundaries unrelated to natural units, there are many small and few large genera because the floras are more diverse, comprising a heterogeneous assemblage of taxa.

Whether the differences between individual local floras are significant or not, Table 4 shows that CHA has marginally the highest percentage of species in large genera at both the five and ten-genus level (15% and 21% respectively), Cederberg is slightly lower (14% and 21%) and CPT lowest (11% and 18%). For families the same pattern is more distinct. Hence, although all three mountain floras exhibit a similar pattern of composition, the CHA flora consistently has the greatest concentration of species within a few large taxa. For an explanation of this regularly repeated sequence we look to the environment and vegetation of the three areas.

CHA has the highest precipitation and greatest extremes of relief: it consists almost entirely of strongly folded mountains of Table Mountain Group sandstones bearing the highly diverse assemblage of fynbos plants typical of the mountains of the southwestern Cape; there is minimal intrusion of coastal or other lowland vegetation such as renosterveld. The Cederberg, a drier landscape of lower rainfall, bears a modified fynbos penetrated on its eastern and western sides by tongues of Karoo-like shrubland and sandveld. At CPT the smaller proportion of mountains is clothed with typical fynbos but on the long shoreline there is a strong coastal component and on the extensive central plateau an abundance of marshy seeps and shallow-soiled flats. In short, the area with the largest proportion of mountain environment, CHA, bears the flora with the greatest concentration of species within a few large genera—a characteristic of typical fynbos of the CFR (Goldblatt 1978).

Family and genus sequences in the Cederberg

Although Asteraceae is the most species-rich family in all three floras in Table 3, in the Cederberg it contributes a considerably higher proportion to the total flora—13.4% compared with an average of 10.9% for the other two floras. Cederberg has remarkably few annual composites, even in genera such as *Felicia* and *Ursinia,* but the shrubby genera are well represented, especially in the drier habitats. Over 80% of Cederberg species of *Euryops, Relhania, Oedera, Othonna* and *Pteronia,* for example, inhabit high-altitude, well-drained rocky outcrops or inland

TABLE 3.—Numbers and cumulative percentages of species in the 10 largest genera and 10 largest families of the three local floras within the Cape Floristic Region

Cederberg (CED)			Cape Hangklip (CHA)			Cape Point (CPT)		
Total no. of species	1778		Total no. of species	1407		Total no. of species	1091	
	No. of spp.	Cum. %		No. of spp.	Cum. %		No. of spp.	Cum. %
Genera								
Erica	83	4.7	*Erica*	98	7.0	*Erica*	38	3.5
Aspalathus	54	7.7	*Aspalathus*	35	9.5	*Ficinia*	26	5.9
Agathosma	41	10.0	*Ficinia*	27	11.4	*Aspalathus*	22	7.9
Pelargonium	34	11.9	*Restio*	22	13.0	*Senecio*	19	9.6
Crassula	30	13.5	*Senecio*	21	14.5	*Tetraria*	19	11.3
Pentaschistis	28	15.2	*Cliffortia*	19	15.9	*Cliffortia*	17	12.9
Phylica	27	16.7	*Elegia*	18	17.2	*Crassula*	17	14.5
Oxalis	26	18.2	*Pelargonium*	17	18.4	*Thesium*	16	16.0
Senecio	25	19.6	*Helichrysum*	16	19.5	*Restio*	12	17.1
Ficinia	24	20.9	*Lobelia*	16	20.6	*Pelargonium*	12	18.2
Families								
Asteraceae	238	13.4	Asteraceae	152	10.8	Asteraceae	120	11.0
Iridaceae	139	21.2	Ericaceae	119	19.3	Iridaceae	78	18.1
Fabaceae	126	28.3	Fabaceae	103	26.6	Cyperaceae	74	24.9
Ericaceae	100	33.9	Restionaceae	100	33.7	Fabaceae	70	31.3
Restionaceae	87	38.8	Iridaceae	98	40.7	Poaceae	64	37.2
Scrophulariaceae	83	43.5	Cyperaceae	71	45.7	Restionaceae	60	42.7
Rutaceae	70	47.4	Poaceae	64	50.2	Orchidaceae	59	48.1
Poaceae	69	51.2	Proteaceae	62	54.6	Ericaceae	48	52.5
Cyperaceae	67	54.9	Orchidaceae	55	58.5	Mesembryanthemaceae	28	55.1
Proteaceae	52	57.8	Campanulaceae	44	61.6	Proteaceae	24	57.3

TABLE 4.—The percentages of the total number of species within the three local floras and the CFR (Cape Floristic Region), that are contained within the first five and first ten families and genera of the floras

		CED	CHA	CPT	CFR
Families	First five	39	41	37	42
	First ten	58	62	57	57
Genera	First five	14	15	11	14
	First ten	21	21	18	20

foothills of Campbell's (1985) Dry Asteraceous Fynbos. Many species in these genera extend eastward into karroid shrubland or northward into the succulent Karoo of Namaqualand. *Euryops* has its highest concentration in the Karoo, and several Karoo species have their southernmost outposts in the dry interior valleys of the Cape including the Cederberg (Nordenstam 1969). Bremer (1976) points out that none of the species of *Relhania* is typically representative of either the Cape or the Karoo floras: their distribution is determined mostly by soil type. It appears that the Cederberg is within an area of overlap between typical fynbos with a core of taxa in the southwestern Cape, and Namaqualand and western Karoo shrublands which comprise a subsidiary centre of speciation.

The family Iridaceae is highly ranked for the same reason: the Cederberg shares some species from the rich Namaqualand region with some from the fynbos region to the south. A few examples among the many species in the northern centre are *Babiana crispa, Ferraria ferrariola, Galaxia stagnalis, Gladiolus pritzelii, G. uysiae* and several species of *Moraea* and *Romulea.*

In the Fabaceae—third largest family in the Cederberg—the genus *Wiborgia* shows similar distribution traits. Species of that genus have deciduous leaves and are found in arid fynbos as well as in 'subdesert scrub' northward in Namaqualand (Dahlgren 1975).

Scrophulariaceae and Rutaceae rank sixth and seventh respectively in the Cederberg flora but are absent from the ten largest families at CPT and CHA. There is a very high component of annuals in Cederberg Scrophulariaceae, especially in genera such as *Diascia, Nemesia, Polycarena* and *Zaluzianskya*, and many new species are being described in current revisions. Dr O.M. Hilliard's new genus *Trieenea*, for example, has five new species that are endemic to the Cederberg, and seven out of a total of nine in the genus, occur there (Hilliard 1989).

The Rutaceae owes its prominence chiefly to the genus *Agathosma* which accounts for nearly 60% of rutaceous species in the Cederberg and is the third largest genus in that flora. *Agathosma* species seem to favour rugged rocky outcrops and well-drained sands (P.A. Bean pers. comm.), habitats common in the uniquely unfolded stratal configuration of the Cederberg Mountains referred to earlier. In his revisions of other genera in Diosmeae, Williams (1982) has reported concentrations of taxa inhabiting mainly rocky situations in the drier inland ranges of the Cape, including the Cederberg. *Diosma*, for instance, has a secondary concentration in the Clanwilliam District in which the Cederberg is situated. Two of the species there, *D. acmaeophylla* and *D. ramosissima*, extend into Namaqualand as far north as Springbok. This is an almost unique range extension in Cape Diosmeae which are narrowly confined to the CFR (Williams 1982). *Macrostylis* occurs only west of the east-west fynbos divide at approximately 20° E longitude (Taylor 1979; Williams 1981) and extends northward via the Cederberg and Gifberg to the vicinity of Vanrhynsdorp. Nearly all species in both *Acmadenia* and *Euchaetis* in the Cederberg grow on rocky upper slopes and have their northern limit there (Bond & Goldblatt 1984).

In the rank sequences for genera (Table 3), *Erica* takes first place in all three floras but is most species-rich in CHA. This is consistent with Campbell's (1985) physiognomic category, Ericaceous Fynbos, which is best represented on the cool, moist slopes of high-altitude, high-rainfall mountains. Of the five types of Ericaceous Fynbos described by Campbell, four are recorded in CHA but only the fifth, the drier type, in the Cederberg.

Four genera ranking among the ten largest in the Cederberg are less well represented in the other two floras—*Agathosma, Pentaschistis, Phylica* and *Oxalis*—and *Agathosma* has already been discussed under Rutaceae.

It is unusual, especially in the western part of the CFR, to find a grass genus as high in the sequence as *Pentaschistis* is in the Cederberg. However, after intensive collecting, the revision by Linder & Ellis (1990) brought to light at least eight new species and four revised names for the Cederberg, many of them confined to high mountains in the northwest of the Fynbos Biome. Recently described taxa of *Pentaschistis*, recorded in the Cederberg checklist, were unknown when the lists for CPT and CHA were compiled. This unilaterally increases the tally for Cederberg, reducing the validity of the comparison with the other two floras.

Phylica, a very large genus of 182 taxa, occurs almost exclusively within the CFR, mostly from an altitude of about 350 m to the tops of the highest peaks. Pillans' (1942) observation that 'the majority [of *Phylica* species] show a preference for exposed and comparatively dry situations' is perfectly consistent with environments in the Cederberg.

Oxalis is a cosmopolitan genus with one concentration in South Africa where 'the great bulk of the species occur in the western coastal belt from Cape Town to Namaqualand, including the western parts of the Ceres and Calvinia Divisions' (Salter 1944). The Cederberg falls exactly within this range and, as already noted, includes habitats that would favour species from the drier northern and eastern regions as well as those from the moister regions further south. In addition, the rigorous climate of the Cederberg, with extreme summer drought and heat, and the generally open vegetation cover, would favour the survival of the geophytic life form. With 26 of the 208 species recognized by Salter fifty years ago, the Cederberg can boast one-eighth of the *Oxalis* flora of South Africa!

Two typical Cape genera, *Restio* and *Cliffortia*, are notably absent from the ten largest genera in the Cederberg.

The absence of *Restio* is due to an artefact of taxonomy similar to that mentioned for *Pentaschistis*. Linder's (1985) conspectus of Restionaceae, in which *Ischyrolepis* is split off from *Restio,* effected a drastic reduction in *Restio* species in the Cederberg which was not reflected in the two earlier checklists for CPT and CHA. The absence of *Cliffortia* from the ten largest genera in the Cederberg, indicates that this genus is more strongly concentrated in the southwest and south of the CFR than in the northwest. This is confirmed by the distribution-density maps I and II given by Weimarck (1934) for the genus.

Finally, less conspicuous families and genera excluded from Table 3 provide further evidence for viewing the Cederberg as a meeting place of two floras. For example, the woody shrubs *Diospyros ramulosa* and *Euclea lancea* (Ebenaceae) with distribution centres in Namaqualand, *E. linearis* from Transvaal and tropical Africa, and *Polemanniopsis marlothii* (Apiaceae) from the western Karoo, all have their southernmost localities in the Cederberg. Similarly, eastern forest taxa such as *Cassine peragua, Hartogiella schinoides* (Celastraceae) and *Platylophus trifoliatus* (Cunoniaceae), and eastern shrubland species like *Euclea acutifolia* and *E. natalensis* (Ebenaceae) extend as far as Cederberg or Gifberg in the extreme northwest.

Conclusions

For its large area the Cederberg is poorer in total species than two local mountain floras in the southwest of the CFR. This may be partly due to the relatively small range of habitats in the Cederberg compared to those in the southwestern mountains. Nevertheless, the fact that Cederberg genera, on average, contain more species than their southwestern counterparts suggests that the Cederberg may be an important local centre of radiation. The Cederberg is, moreover, a meeting place where the driest flora of the winter rainfall region in the north overlaps the wetter flora of the south, as is evident from the many examples of shared taxa given above.

This lack of distinction between floristic boundaries supports Bayer's (1984) case for a wider concept of the CFR which would embrace the northern part of the winter rainfall region, as well as the region of Cape fold mountains, thereby creating a greater awareness of the need for better conservation of the flora and vegetation of the northern part.

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Checklist

This checklist of vascular plants in the Cederberg was compiled from the following sources:

1, my own collections from the mid-1950's to 1994 (numbers prefixed by the letter 'T');

2, all species cited by Bond & Goldblatt (1984) as occurring within the Cederberg;

3, extensive searches in Cape herbaria (BOL, NBG, SAM and STE) for Cederberg records of species cited by Bond & Goldblatt (1984) as occurring in non-coastal habitats in the Clanwilliam District;

4, literature, especially taxonomic revisions published from 1983 onwards, where authors refer to, or cite specimens from localities within the Cederberg;

5, specimen or locality citations given to me by authors of current revisions;

6, a PRECIS printout, dated 28.3.1990, of the grid-square 3219 AC (90% of which falls within the study area) for collection records from Cederberg localities (cited as 'PRECIS 1990');

7, a manuscript list, dated 1984, of Cederberg collections held by the erstwhile Department of Forestry's herbarium at Jonkershoek (cited as 'Forestry 1984'). Many of these specimens are now housed at PRE;

8, a few voucher 'field-specimens' held in 1986 at the Algeria centre in the Cederberg (cited as 'Forestry 1986');

9, a few records of additional well-known plants that were observed during my survey but not recorded from other sources (cited as 'Taylor sight records').

In the list, voucher specimens are printed in italics. Literature references quoted in the list are cited in full in the References. Naturalized exotic species are marked with an asterisk (*). There are no longer any invading alien plants in the conservation area. Alien species in commercial plantations, and ornamentals planted in the administrative and residential complexes, are excluded from the list. The symbols X (extinct), E (endangered), V (vulnerable), R (critically rare), I (indeterminate) and U (uncertain) given for some taxa in the list indicate their threatened status category, according to Hall & Veldhuis (1985).

A card index that records locality details of my specimens and some others, is available for reference at my home address where I also keep a small collection of duplicate 'mini-specimens'. Most of my original specimens are housed at STE or PRE; some early numbers, and duplicates, may be in BOL, NBG or SAM. My specimens were identified by the research staff of these herbaria, especially STE, or by specialists working elsewhere.

Taxa are recorded to species level, subspecific ranks being excluded. Specimens that could be named only to genus level are recorded as 'sp.' for a single specimen or as 'spp.' where more than one taxonomic concept may be implied. The latter usually indicates that the taxon is currently being revised; such cases were often discussed with the taxonomists concerned.

Nomenclature follows Arnold & De Wet (1993) but author names are abbreviated in accordance with Brummitt & Powell (1992). The checklist was brought as up to date as possible on completion in April 1994.

PTERIDOPHYTA

ADIANTACEAE
Cheilanthes
capensis *(Thunb.) Sw.*, Schelpe & Anthony 1986
contracta *(Kunze) Mett. ex Kuhn, T 10573*
depauperata *Baker*, Schelpe & Anthony 1986, U
hastata *(L.f.) Kunze*, Schelpe & Anthony 1986
induta *Kunze, T 10595, 11496, 11841*
multifida *(Sw.) Sw., T 11318, 11907, 12228*
Pellaea pteroides *(L.) Prantl, T 11476, 11563, 11990*

ASPIDIACEAE
Polystichum monticola *N.C.Anthony & Schelpe*, Schelpe & Anthony 1986
Dryopteris callolepis *C.Chr.*, Schelpe & Anthony 1986

ASPLENIACEAE
Ceterach cordatum *(Thunb.) Desv.*, Schelpe & Anthony 1986

BLECHNACEAE
Blechnum
australe *L.*, Schelpe & Anthony 1986
inflexum *(Kunze) Kuhn*, Schelpe & Anthony 1986
punctulatum *Sw.*, Schelpe & Anthony 1986

DENNSTAEDTIACEAE
Pteridium aquilinum *(L.) Kuhn*, Schelpe & Anthony 1986

GLEICHENIACEAE
Gleichenia polypodioides *(L.) J.E.Sm., T 7474*

HYMENOPHYLLACEAE
Hymenophyllum tunbridgense *(L.) J.E.Sm.*, Schelpe & Anthony 1986

LYCOPODIACEAE
Lycopodium
carolinianum *L.*, Schelpe & Anthony 1986
cernuum *L., T 12258*

OPHIOGLOSSACEAE
Ophioglossum bergianum *Schltdl.*, Schelpe & Anthony 1986

OSMUNDACEAE
Osmunda regalis *L., T 12035*
Todea barbara *(L.) T.Moore, T 12036, 12063*

SCHIZAEACEAE
Mohria caffrorum *(L.) Desv., T 11833, 11934, 11989*
Schizaea
pectinata *(L.) Sw., T 11726*
tenella *Kaulf.*, Schelpe & Anthony 1986

SELAGINELLACEAE
Selaginella pygmaea *(Kaulf.) Alston*, Schelpe & Anthony 1986

GYMNOSPERMAE

CUPRESSACEAE
Widdringtonia cedarbergensis *Marsh*, Bond & Goldblatt 1984, V

PODOCARPACEAE
Podocarpus elongatus *(Aiton) L'Hér. ex Pers., T 7484*

ANGIOSPERMAE–MONOCOTYLEDONAE

AMARYLLIDACEAE
Amaryllis belladonna *L.*, Forestry 1984
Brunsvigia minor *Lindl., T 11301*
Cyrtanthus angustifolius *(L.f.) Aiton*, Forestry 1984
Gethyllis
spiralis *(Thunb.) Thunb.*, Forestry 1984
spp., *Boucher 2048, T 12254*
Haemanthus
coccineus *L., Viviers 136*
crispus *Snijman, Salter 7523*
sanguineus *Jacq., Esterhuysen 20041, Snijman 433*
Hessea monticola *Snijman, T 11510*
Nerine
humilis *(Jacq.) Herb., Pocock (PRE 30286), T 11738*
laticoma *(Ker Gawl.) T.Durand & Schinz, T 8449*
sarniensis *(L.) Herb., Marsh 51*

ARACEAE
Zantedeschia aethiopica *(L.) Spreng.*, Taylor sight records Kliphuis and Pilaarsberg

ASPARAGACEAE
Myrsiphyllum
asparagoides *(L.) Willd., T 028.A*
fasciculatum *(Thunb.) Oberm., T 8492, 10942*
kraussianum *Kunth, T 11006*
multituberosum *(R.A.Dyer) Oberm.*, Obermeyer 1984
ovatum *(T.M Salter) Oberm., T 11874*
Protasparagus
aethiopicus *(L.) Oberm., T 11666, 12064*
capensis *(L.) Oberm., T 10943*
compactus *(T.M. Salter) Oberm., T 11500*
lignosus *(Burm.f.) Oberm., Haynes 1203, Viviers 1312*
retrofractus *(L.) Oberm., T 10996*
rubicundus *(P.J.Bergius) Oberm.*, PRECIS 1990
suaveolens *(Burch.) Oberm., T 10981, 11529*

ASPHODELACEAE
Aloe
glauca *Mill., Van Jaarsveld 4504*
khamiesensis *Pillans, T 10948*
mitriformis *Mill., T 10916*
Bulbine
diphylla *Schtr. ex Poelln.*, Bond & Goldblatt 1984
favosa *(Thunb.) Roem. & Schult.*, Forestry 1984
flexicaulis *Baker*, Bond & Goldblatt 1984
minima *Baker, T 11028*
torta *N.E.Br., Esterhuysen 20466, Kerfoot 5969, T 129.48*
tuberosa *(Mill.) Oberm., T 11512*
Bulbinella
cauda-felis *(L.f.) T.Durand & Schinz, Barker 300, Esterhuysen s.n. (NBG 83376)*
divaginata *P.L.Perry, Perry 3105*
elata *P.L.Perry, Esterhuysen 5295*
graminifolia *P.L.Perry, H. Bolus s.n.(BOL 32606)*
latifolia *Kunth, Viviers 622*
nutans *(Thunb.) T.Durand & Schinz, Perry 3250*
punctulata *Zahlbr., Perry 3173*
triquetra *(L.f.) Kunth, Esterhuysen 20564, Forsyth 148, Galpin 11121, Pocock 156, T 11957*
Caesia contorta *(L.f.) T.Durand & Schinz, T 10863*
Chlorophytum
pauciphyllum *Oberm.*, Bond & Goldblatt 1984
undulatum *(Jacq.) Oberm., T 5086*
Kniphofia uvaria *(L.) Oken*, Bond & Goldblatt 1984
Trachyandra
hirsutiflora *(Adamson) Oberm., Barker 4699, Compton 16200*
jaquiniana *(Roem. & Schult.) Oberm., Stokoe (SAM 55875)*
muricata *(L.f.) Kunth, Esterhuysen 8143, Levyns 7214*
paniculata *Oberm., Macowan 1985*
patens *Oberm., Schlechter 10791*
revoluta *(L.) Kunth*, Forestry 1986

COLCHICACEAE
Androcymbium cuspidatum *Baker*, Bond & Goldblatt 1984
Onixotis punctata *(L.) Mabberley, T 11780*
Wurmbea minima *B.Nord.*, Bond & Goldblatt 1984

CYPERACEAE
Carpha
bracteosa *C.B.Clarke, Arnold 1002*
glomerata *(Thunb.) Nees, Compton 6944*
Chrysithrix junciformis *Nees*, Bond & Goldblatt 1984
Cyperus
denudatus *L.f., T 10872*
longus *L., T 11200, 11202*
marginatus *Thunb., T 11148*
sphaerospermus *Schrad., T 11199, 11203*
tenellus *L.f.*, PRECIS 1990
Epischoenus
adnatus *Levyns*, PRECIS 1990
cernuus *Levyns, Esterhuysen 17982*
dregeanus *(Boeck.) Levyns, T 11286, 11300, 11701*
gracilis *Levyns, T 11687*
Ficinia
acuminata *(Nees) Nees, T 11077, 11111*
angustifolia *(Schrad.) Levyns, Esterhuysen 12214*
brevifolia *Nees ex Kunth, T 11375, 11549*
bulbosa *(L.) Nees, T 11392*
capillifolia *(Schrad.) C.B.Clarke*, Bond & Goldblatt 1984
capitella *(Thunb.) Nees, T 11366*
cedarbergensis *T.H.Arnold & Gordon-Gray, T 8472, 8489, 10585, 10911, 11248*
deusta *(P.J.Bergius) Levyns, T 8490*
dunensis *Levyns, T 8543, 11595*
fascicularis *Nees, T 11402*
filiformis *(Lam.) Schrad., T 11664*
gydomontana *T.H.Arnold, Esterhuysen 18053*, R
indica *(Lam.) Pfeiff., T 5112, 5127, 10479, 11066, 11343, 11898*
involuta *Nees, T 5115*
ixioides Nees, *T 10592, 11374*
lucida *C.B.Clarke*, Bond & Goldblatt 1984
mucronata *C.B.Clarke*, Bond & Goldblatt 1984
nigrescens *(Schrad.) J.Raynal, T 10564, 10565, 10951*
oligantha *(Steud.) J.Raynal, Arnold 1004, Esterhuysen 18050*
secunda *(Vahl) Kunth, T 5082*
tenuifolia *Kunth, T 7487a*
sp., *T 10586, 11373*
sp. nov. (= *Esterhuysen 27008*), *T 11402, 11618*
sp. nov., *T 10767, 11651*
Fuirena hirsuta *(P.J.Bergius) P.L.Forbes, T 10891*
Isolepis
antarctica *(L.) Roem. & Schult., Esterhuysen 12060*
digitata *Schrad., T 7449, 12243*
fluitans *(L.) R.Br., T 11167*
hystrix *(Thunb.) Nees*, Bond & Goldblatt 1984
marginata *(Thunb.) A.Dietr., T 9276*
natans *(Thunb.) A.Dietr.*, PRECIS 1990
prolifer *R.Br.*, Taylor sight record, Taaiboschkraal stream
rubicunda *Kunth, T 11151*
tenuissima *(Nees) Kunth*, PRECIS 1990
Macrochaetium
ecklonii *(Nees) Levyns, T 10838, 11714*
hexandrum *(Nees) Pfeiff.*, Bond & Goldblatt 1984, Forestry 1984
Mariscus thunbergii *(Vahl) Schrad.*, PRECIS 1990
Scirpus dioecus *(Kunth) Boeck.*, PRECIS 1990
Tetraria
bolusii *C.B.Clarke, T 11525*
compar *(L.) T.Lestib., T 11388*
crinifolia *(Nees) C.B.Clarke*, PRECIS 1990, *T 97.14, 882.7, 886.3*
cuspidata *(Rottb.) C.B.Clarke, T 7493, 11492, 11505, 11776*
ferruginea *C.B.Clarke*, Bond & Goldblatt 1984
graminifolia *Levyns, Le Maitre 200*
involucrata *(Rottb.) C.B.Clarke, T 8482*

Tetraria (cont.)
ligulata *C.B.Clarke, T 7486a, 11286, 11491*
maculata *Schönland & Turrill*, Bond & Goldblatt 1984
nigrovaginata *(Nees) C.B.Clarke, T 8467, 10921*
picta *(Boeck.) C.B.Clarke*, Bond & Goldblatt 1984
pubescens *Schönland & Turrill, T 5101, 11702*
triangularis *(Boeck.) C.B.Clarke, T 8477*
ustulata *(L.) C.B.Clarke, T 10920*
vaginata *Schönland & Turrill*, Bond & Goldblatt 1984
sp. nov., *T 11230, 11698, 11712, 11945*
sp. nov., *T 11241*

DIOSCOREACEAE

Dioscorea elephantipes *(L'Hér.) Engl., T 10781, 10945*

ERIOSPERMACEAE

Eriospermum
aphyllum *Marloth, Leipoldt 4231*
capense *(L.) Thunb., Esterhuysen 21132*
flavum *P.L.Perry*, Perry MS
graminifolium *A.V.Duthie, Esterhuysen 13875, 25555a*
lanceifolium *Jacq., A.R. Mitchell 476*
lanuginosum *Jacq., T 11397*
cf. nanum *Marloth, T 10929*
paradoxum *(Jacq.) Ker Gawl., Esterhuysen (NBG 2502/34)*
patentiflorum *Schltr., Schlechter 10794*, U
proliferum *Baker, Bruyns 2368, Perry 3098*
pumilum *T.M.Salter*, Perry 1991
cf. pustulatum *Marloth ex A.V.Duthie, Wagener 71*
spirale *(L.) P.J.Bergius, T 9587*
subincanum *P.L.Perry, Perry 1026*
subtile *P.L.Perry*, Perry 1991

HAEMODORACEAE

Dilatris ixioides *Lam., T 10473, 11685*

Wachendorfia
laxa *W.F.Barker* MS, *T 11090, 11141, 11376*
paniculata *Burm., T 11822*

HYACINTHACEAE

Albuca
cf. altissima *Dryand.*, Forestry 1986
cf. canadensis *(L.) F.M.Leighton*, Forestry 1984
cooperi *Baker, T 6158a, 11852*
massonii *Baker*, Bond & Goldblatt 1984

Lachenalia
aloides *(L.f.) Engl., Barnes (BOL 21936), Barker 3060*
bolusii *W.F.Barker*, Bond & Goldblatt 1984
elegans *W.F.Barker, T 11853*
esterhuyseniae *W.F.Barker*, Bond & Goldblatt 1984, U
hirta *(Thunb.) Thunb., Nordenstam & Lundgren 2029*
margaretae *W.F.Barker*, Bond & Goldblatt 1984, U
marginata *W.F.Barker*, Bond & Goldblatt 1984
maximiliani *Schltr. ex W.F.Barker*, Bond & Goldblatt 1984
mutabilis *Sweet*, Forestry 1984
orchioides *(L.) Aiton*, Bond & Goldblatt 1984
pusilla *Jacq., Müller-Doblies 80132b, T 12120*
unicolor *Jacq., Barker 3059, Leipoldt (BOL 20785), T 9326*
ventricosa *Schltr. ex W.F.Barker*, Bond & Goldblatt 1984

Massonia echinata *L.f.*, PRECIS 1990

Neobakeria heterandra *F.M.Leighton, Esterhuysen 21370, Pocock 11116*

Ornithogalum
conicum *Jacq.*, Bond & Goldblatt 1984, Taylor colour slide 173/30
dubium *Houtt., T 10616*
fimbrimarginatum *F.M.Leighton, T 11137*
graminifolium *Thunb., Stokoe 7321*
maculatum *Jacq., T 10616, 11088*
nanodes *F.M.Leighton, Esterhuysen 17959*
suaveolens *Jacq., T 6165*
subcoriaceum *L.Bolus, Kruger 918*
thyrsoides *Jacq., T 11887*
xanthochlorum *Baker*, Bond & Goldblatt 1984

Rhadamanthus
convallarioides *(L.f.) Baker, Salter 5025*
montanus *B.Nord., Esterhuysen 7423, 22474*
platyphyllus *B.Nord., Esterhuysen 18135*
Tenicroa filifolia *(Jacq.) Oberm., Compton 12730, Gouws 202*
Urginea pusilla *(Jacq.) Baker*, Bond & Goldblatt 1984
Whiteheadia bifolia *(Jacq.) Baker*, Bond & Goldblatt 1984

HYPOXIDACEAE

Spiloxene
aquatica *(L.f.) Fourc., Stokoe (SAM 55739)*
capensis *(L.) Garside, T 11901*, I
minuta *(L.) Fourc., T 5109*
schlechteri *(Bolus) Garside, T 5105*
umbraticola *(Schltr.) Garside*, PRECIS 1990, U
sp. (Spiloxinella MS), *T 11869*

IRIDACEAE

Aristea
africana *(L.) Hoffmanns.*, PRECIS 1990
cuspidata *Schinz*, PRECIS 1990
dichotoma *(Thunb.) Ker Gawl., T 6191, 11709*
monticola *Goldblatt, Le Maitre 624, T 12090*
singularis *Weim., T 11009*, R

Babiana
ambigua *(Roem. & Schult.) G.J.Lewis, T 11011*
auriculata *G.J.Lewis*, Bond & Goldblatt 1984, R
cedarbergensis *G.J.Lewis*, Bond & Goldblatt 1984, R
crispa *G.J.Lewis*, Bond & Goldblatt 1984
disticha *Ker Gawl.*, Forestry 1984
mucronata *(Jacq.) Ker Gawl.*, Bond & Goldblatt 1984

Bobartia
fasciculata *J.B.Gillett ex Strid*, Oliver et al. 1983, U
rufa *Strid, T 10803*

Chasmanthe floribunda *(Salisb.) N.E.Br.*, Bond & Goldblatt 1984
Ferraria ferrariola *(Jacq.) Willd.*, Bond & Goldblatt 1984
Freesia occidentalis *L.Bolus, Goldblatt 4069*

Galaxia
citrina *G.J.Lewis, Esterhuysen 8104, 13033*
luteoalba *Goldblatt, Goldblatt 2205*
ovata *Thunb., Goldblatt 3878*
stagnalis *Goldblatt, Goldblatt 3883*

Geissorhiza
aspera *Goldblatt, T 11126, 11802*
bolusii *Baker, T 11636*
cedarmontana *Goldblatt*, Bond & Goldblatt 1984
ciliatula *Goldblatt*, Bond & Goldblatt 1984
confusa *Goldblatt, T 1839, 10765, 11143*
erubescens *Goldblatt*, Bond & Goldblatt 1984
juncea *(Link) A.Dietr.*, Bond & Goldblatt 1984
minuta *Goldblatt*, Bond & Goldblatt 1984
ornithogaloides *Klatt*, Bond & Goldblatt 1984
parva *Baker*, Bond & Goldblatt 1984
scillaris *A.Dietr.*, Bond & Goldblatt 1984
sulphurascens *Schltr. ex R.C.Foster, T 12080*
unifolia *Goldblatt*, Bond & Goldblatt 1984

Gladiolus
alatus *L., Barker 2001, Lewis (BOL 22268)*
angustus *L., T 1849*
buckerveldii *(L.Bolus) Goldblatt*, Delpierre & Du Plessis 1973, R
carinatus *Aiton, T 1651*
caryophyllaceus *(Burm.f.) Poir., T 10703*
delpierrei *Goldblatt*, Bond & Goldblatt 1984, R
floribundus *Jacq., Wagener 280*
hyalinus *Jacq., Lewis (BOL), Stokoe (SAM 55659)*
inflatus *Thunb., T 10587, 10649, 11765*, I
liliaceus *Houtt., T 1624, 7444*
odoratus *L.Bolus, Lewis 6140, Salter 8137*
oreocharis *Schltr., Esterhuysen 7551, 15020, T 1864*, R
pillansii *G.J.Lewis, T 11305*
pritzelii *Diels, Primos 11709, T 6147*
scullyi *Baker, Lewis 5221, Salter 3631, Wagener 141*
tristis *L., T 1844, 10496*
undulatus *L.*, Forestry 1984, Taylor sight record Slangvlei (& colour slide)
uysiae *L.Bolus ex G.J.Lewis, Wagener 206*
violaceo-lineatus *G.J.Lewis, Esterhuysen 5920, Horrocks 94*, R

Gynandriris cedarmontana *Goldblatt*, Bond & Goldblatt 1984

Hesperantha
bachmannii *Baker, Goldblatt 229*
cedarmontana *Goldblatt, Esterhuysen 3192, Goldblatt 7120, Kerfoot 5964*
elsiae *Goldblatt, Esterhuysen 17966*
falcata *(L.f.) Ker Gawl., Goldblatt 6399, Oliver 4019*

Hesperantha (cont.)
pilosa *(L.f.) Ker Gawl., Barker 261, Esterhuysen 13141, Goldblatt 5134*
radiata *(Jacq.) Ker Gawl., Acocks 2216, Esterhuysen 7232, T 11900*
Homeria
bifida *L.Bolus*, Bond & Goldblatt 1984
cedarmontana *Goldblatt*, Bond & Goldblatt 1984, R
cookii *L.Bolus*, Bond & Goldblatt 1984
flavescens *Goldblatt*, Bond & Goldblatt 1984
miniata *(Andrews) Sweet*, Forestry 1984
ochroleuca *Salisb., T 10643, 11547*
patens *Goldblatt*, Bond & Goldblatt 1984, R
tenuis *Schltr.*, Bond & Goldblatt 1984
Ixia
capillaris *L.f., Esterhuysen 3184*
flexuosa *L., Thode A2138*
latifolia *D.Delaroche, T 1850*
paniculata *D.Delaroche, Thode 2139*
pauciflora *G.J.Lewis, Barker 3781, Wagener 140*
paucifolia *G.J Lewis, Compton 9702, Esterhuysen 12153*
polystachya *L.*, PRECIS 1990
rapunculoides *D.Delaroche*, PRECIS 1990
scillaris *L.*, PRECIS 1990
Lapeirousia
divaricata *Baker, Bolus 9100, MacOwan 1975*
fabricii *(D.Delaroche) Ker Gawl., Goldblatt 9502*
jacquinii *N.E.Br., Barker 1309*
micrantha *(E.Mey. ex Klatt) Baker, Goldblatt 5150*
Melasphaerula ramosa *(L.) N.E.Br.*, Bond & Goldblatt 1984, Taylor sight records
Micranthus
alopecuroides *(L.) Rothm.*, PRECIS 1990
junceus *(Baker) N.E.Br.*, Forestry 1984
tubulosus *(Burm.f.) N.E.Br., Pocock 586, 805*
Moraea
angusta *(Thunb.) Ker Gawl., Pocock 328*
anomala *G.J.Lewis, T 11834*
barkerae *Goldblatt*, Goldblatt 1986, R
ciliata *(L.f.) Ker Gawl., T 11013*
crispa *Thunb.*, Goldblatt 1986
fugax *(D.Delaroche) Jacq.*, Goldblatt 1986
gawleri *Spreng.*, Goldblatt 1986
gracilenta *Goldblatt*, Goldblatt 1986
inconspicua *Goldblatt*, Goldblatt 1986
macrocarpa *Goldblatt*, Goldblatt 1986
macronyx *G.J.Lewis, Viviers 471*
neglecta *G.J.Lewis*, Goldblatt 1986
papilionacea *(L.f.) Ker Gawl.*, Goldblatt 1986
pseudospicata *Goldblatt*, Goldblatt 1986
ramosissima *(L.f.) Druce*, Goldblatt 1986
tricuspidata *(L.f.) G.J.Lewis*, Goldblatt 1986
tripetala *(L.f.) Ker Gawl.*, Goldblatt 1986
unguiculata *Ker Gawl.*, Goldblatt 1986
Rheome maximiliani *(Schltr.) Goldblatt*, Bond & Goldblatt 1984
Romulea
atrandra *G.J.Lewis, T 5106*
cedarbergensis *De Vos, De Vos 2030, Esterhuysen 8043, Stokoe (SAM 63691)*, U
flava *(Lam.) De Vos, De Vos 2043, Stokoe (SAM 63695)*
hirta *Schltr., Schlechter 8766*
leipoldtii *Marais, De Vos 1466, MacOwan (SAM 20725)*
luteoflora *(De Vos) De Vos, Barnes (BOL 19471), De Vos 2031*
minutiflora *Klatt, De Vos 1647, 2032*
montana *Schltr. ex Bég., Schlechter 8648*, I*8847*
rosea *(L.) Eckl., Barker 261, Esterhuysen 8042, 21754*
saxatilis *De Vos, Esterhuysen 12171, T 11021*
schlechteri *Bég., Malan (STE 30313), Schlechter 8648*
stellata *De Vos, T 11321*
sulphurea *Bég., Schlechter 10818*, X
tabularis *Eckl. ex Bég., Marloth 2658*
triflora *(Burm.f.) N.E.Br., Stokoe (SAM 68325)*
vinacea *De Vos, Barker 6591, De Vos 1921, Leipoldt (BOL 21278)*, R
viridibracteata *De Vos, De Vos 1668, Salter 3652*, U
Sparaxis variegata *(L.Bolus) Goldblatt, Barker 4700, Wisura 1754*
Syringodea longituba *(Klatt) Kunze, De Vos 2208*
Thereianthus
bracteolatus *(Lam.) G.J.Lewis, Schlechter 9765*
juncifolius *(Baker) G.J.Lewis, T 11482*
Tritonia
crispa *(L.f.) Ker Gawl., Middlemost 1910, Thode A2181*
parvula *N.E.Br., Esterhuysen 18009*
Tritoniopsis
antholyza *(Poir.) Goldblatt, T 11659, 11684*
latifolia *G.J.Lewis, T 10915*, R
longituba *(Fourc.) Goldblatt, Compton 6308, Esterhuysen 25524*
nemorosa *(E.Mey. ex Klatt) G.J.Lewis, Viviers 8*
nervosa *(Baker) G.J.Lewis, T 6205, 10874*
parviflora *(Jacq.) G.J.Lewis, Thode A2783*
ramosa *(Eckl. ex Klatt) G.J.Lewis, Viviers 142*
Watsonia
angusta *Ker Gawl., T 11218, 12121*
fourcadei *J.W.Mathews & L.Bolus*, Goldblatt 1989
marginata *(L.f.) Ker Gawl., T 11679*
meriana *(L.) Mill.*, PRECIS 1990
stokoei *L.Bolus, T 11723*
vanderspuyiae *L.Bolus, T 11860*

JUNCACEAE
Juncus
bufonius *L.*, PRECIS 1990
capensis *Thunb., T 11713*
effusus *L., T 11206*
lomatophyllus *Spreng., T 8480a, 10873, 11951*
Prionium serratum *(L.f.) Drège ex E.Mey.*, Bond & Goldblatt 1984, Taylor sight records

ORCHIDACEAE
Ceratandra globosa *Lindl., Compton 12746, T 12255*
Corycium
crispum *(Thunb.) Sw., Lewis 5226*
deflexum *(Bolus) Rolfe, Bolus 8660, Wagener 229*
Disa
atricapilla *(Harv. ex Lindl.) Bolus, T 11615, 12221*
caulescens *Lindl.*, Bond & Goldblatt 1984
cedarbergensis *H.P.Linder, Linder 4462*
draconis *(L.f.) Sw., T 1625, 12247*
elegans *Sond. ex Rchb.f., Linder 1645, Pocock 594*
esterhuyseniae *Schelpe ex H.P.Linder*, Bond & Goldblatt 1984
filicornis *(L.f.) Thunb., T 11162*
lineata *Bolus*, Bond & Goldblatt 1984
ovalifolia *Sond., Barnes & Weintroub (BOL 19320), Bodkin (BOL 9092)*, R
salteri *G.J.Lewis*, Bond & Goldblatt 1984, R
telipogonis *Rchb.f.*, Bond & Goldblatt 1984
triloba *Lindl., T 10827*
uncinata *Bolus*, Bond & Goldblatt 1984
uniflora *P.J.Bergius*, Forestry 1984
venosa *Sw.*, PRECIS 1990
Disperis
bolusiana *Schltr. ex Bolus, Steiner 714*
capensis *(L.) Sw., T 11769*
circumflexa *(L.) T.Durand & Schinz, Barker 4702, Lewis 22271*
villosa *(L.f.) Sw.*, Bond & Goldblatt 1984
Herschelianthe
multifida *(Lindl.) Rauschert*, Linder 1981b
spathulata *(L.f.) Rauschert*, Linder 1981b
Holothrix
secunda *(Thunb.) Rchb.f., T 11807*
villosa *Lindl., Pocock 609*
Monadenia
bracteata *(Sw.) T.Durand & Schinz*, Linder 1981a
comosa *Rchb.f.*, Linder 1981a
Pterygodium catholicum *(L.) Sw.*, Forestry 1984
Satyrium
bicorne *(L.) Thunb., T 11635*
erectum *Sw., T 10709, 11347*
humile *Lindl., T 11862*
pumilum *Thunb., T 11142*
Schizodium
bifidum *(Thunb.) Rchb.f.*, PRECIS 1990
inflexum *Lindl., T 11089*

POACEAE
Aira cupaniana *Guss. *, T 7529, 12084*
Andropogon appendiculatus *Nees, T 11725*
Anthoxanthum
dregeanum *(Nees) Stapf*, Bond & Goldblatt 1984
tongo *(Trin.) Stapf, T 11127*
Aristida
diffusa *Trin., T 10815*
junciformis *Trin. & Ruprecht*, Bond & Goldblatt 1984

Cymbopogon marginatus *(Steud.) Stapf ex Burtt Davy*, Forestry 1984
Cynodon dactylon *(L.) Pers.*, Bond & Goldblatt 1984, De Wet & Harlan 1971
Ehrharta
cf. brevifolia *Schrad., T 11846*
calycina *J.E.Sm., T 11576, 11948*
capensis *Thunb., T 11880*
longifolia *Schrad.*, PRECIS 1990
microlaena *Nees ex Trin., T 10902*
ramosa *(Thunb.) Thunb., T 11601, 11632, 11890*
thunbergii *Gibbs Russ., T 11579*
villosa *Schult.f., T 10738, 11502, 11577, 11582*
Eragrostis
capensis *(Thunb.) Trin., T 6186*
curvula *(Schrad.) Nees, T 10958, 11758*
Festuca scabra *Vahl, T 5136*
Fingerhuthia africana *Lehm., T 10582*
Holcus setiger *Nees, Ellis 5515*
Hyparrhenia hirta *(L.) Stapf, T 11612*
Imperata cylindrica *(L.) Raeusch.*, T relevés 181, 182
Merxmuellera
arundinacea *(P.J.Bergius) Conert, T 11027*
cincta *(Nees) Conert, T 11219*
rufa *(Nees) Conert*, PRECIS 1990
stricta *(Schrad.) Conert, T 10742*
Paspalum dilatatum *Poir. *, T 11727*
Pennisetum
macrourum *Trin., T 10779*
thunbergii *Kunth, Thompson 1539*
Pentameris
dregeana *Stapf, T 11590, 11622*
macrocalycina (Steud.) Schweick., *T 5131, 10680, 11113*
Pentaschistis
airoides *(Nees) Stapf*, Bond & Goldblatt 1984
alticola *H.P.Linder, Esterhuysen 17987*
ampla *(Nees) McClean, T 11504*
aristidoides *(Thunb.) Stapf, T 11381*
barbata *(Nees) H.P.Linder, Ellis 2507*
colorata *(Steud.) Stapf, Acocks 19848, Ellis 2506*
curvifolia *(Schrad.) Stapf, T 6137, 10773, 11134*
densifolia *(Nees) Stapf, T 6151, 11899*
elegans *(Nees) Stapf*, Bond & Goldblatt 1984
eriostoma *(Nees) Stapf, T 6181, 10826, 11158*
glandulosa *(Schrad.) H.P.Linder, Esterhuysen 18158*
malouinensis *(Steud.) Clayton*, Bond & Goldblatt 1984
montana *H.P.Linder, Esterhuysen 18033, 18155, T 6141*
pallescens *(Schrad.) Stapf, Ellis 2505*
pallida *(Thunb.) H.P.Linder, T 7511, 11668*
cf. pallida *(Thunb.) H.P.Linder, T 12244*
patula *(Nees) Stapf, Linder 4330*
pungens *H.P.Linder, Ellis 5791, Esterhuysen 13030, T 5138*
pusilla *(Nees) H.P.Linder, T 10899*
pyrophila *H.P.Linder, T 10688, 11067*
reflexa *H.P.Linder, Ellis 5786*
rigidissima *Pilg. ex H.P.Linder, T 12230*
rosea *H.P.Linder, T 11153*
rupestris *(Nees) Stapf, T 6200, 11503*
triseta *(Thunb.) Stapf, T 12085*
velutina *H.P.Linder, T 10468, 11381, 11838*
viscidula *(Nees) Stapf, T 10817, 11837*
sp., *T 5138, 11292*
Phragmites australis *(Cav.) Steud.*, Bond & Goldblatt 1984
Poa bulbosa *L.*, PRECIS 1990
Stipagrostis zeyheri *(Nees) De Winter, T 10737*
Themeda triandra *Forssk.*, Forestry 1984, Taylor sight records, e.g. Amon Track and Taaiboschkraal
Tribolium
brachystachyum *(Nees) Renvoize, T 12086*
hispidum *(Thunb.) Desv., Edwards 160, Esterhuysen 18159A, Le Maitre 303, T 7491, 10525*
uniolae *(L.f.) Renvoize, T 10719, 11583, 11716*
Vulpia
bromoides *(L.) Gray *, T 11844*
myuros *(L.) C.C.Gmel. *, Du Toit 1560, 1732, Spies 3849*

RESTIONACEAE
Anthochortus singularis *Esterh., Esterhuysen 22436*
Askidiosperma
albo-aristatum *(Pillans) H.P.Linder, T 10889*
capitatum *Steud., T 10854*
insigne *(Pillans) H.P.Linder*, Oliver et al. 1983
nitidum *(Mast.) H.P.Linder, T 8481, 10515, 11053*
paniculatum *(Mast.) H.P.Linder*, Linder 1985
Calopsis
dura *Esterh.*, Linder 1985
esterhuyseniae *(Pillans) H.P.Linder*, Linder 1985
marlothii *(Pillans) H.P.Linder, T 8475, 10666, 10924, 11041, 11243*
paniculata (Rottb.) Desv., *T 10998, 12033*
rigorata *(Mast.) H.P.Linder, T 8488, 10717*
viminea *(Rottb.) H.P.Linder, T 11263, 11304, 11391, 11395, 11409, 11593*
Cannomois
aristata *Mast., T 11750*, U
congesta *Mast., T 5124*
nitida *(Mast.) Pillans, T 11130*
parviflora *(Thunb.) Pillans, T 7509a, 8465, 8535, 10564, 10679, 11550, 11647*
taylorii *H.P.Linder, Forsyth 253, Haynes 1548, Linder 4471, T 7534, 8495, 9350, 11717*
virgata *(Rottb.) Steud., T 5137*
Dovea macrocarpa *Kunth*, Oliver et al. 1983
Elegia
asperiflora *(Nees) Kunth, T 11239, 11265, 11279*
capensis *(Burm.f.) Schelpe*, Oliver et al. 1983
esterhuyseniae *Pillans*, Linder 1985
filacea *Mast., T 11246, 11285, 11673, 11711*
grandispicata *H.P.Linder*, Linder 1985
neesii *Mast., T 10853*
vaginulata *Mast.*, Oliver et al. 1983
Hydrophilus rattrayi *(Pillans) H.P.Linder, T 11031*
Hypodiscus
argenteus *(Thunb.) Mast., T 10730*
aristatus *(Thunb.) Krauss, Esterhuysen 7848*
laevigatus *(Kunth) H.P.Linder, T 6827, 10536, 11240*
neesii *Mast., T 11020, 11037, 11052*
cf. squamosus *Esterh., T 10656*
striatus *(Kunth) Mast.*, Oliver et al. 1983
Ischyrolepis
capensis *(L.) H.P.Linder*, Oliver et al. 1983
curviramis *(Kunth) H.P.Linder, T 5128, 10717, 10726, 11030, 11244, 11293, 11382*
distracta *(Mast.) H.P.Linder, T 11404*
fraterna *(Kunth) H.P.Linder*, Oliver et al. 1983
gaudichaudiana *(Kunth) H.P.Linder, T 10924, 11245, 12046, 12050, 12057*
gossypina *(Mast.) H.P.Linder, T 11656, 11777*
laniger *(Kunth) H.P.Linder, T 6160, 10690, 11644*
macer *(Kunth) H.P.Linder*, Oliver et al. 1983
marlothii *(Pillans) H.P.Linder*, Oliver et al. 1983
monanthos *(Mast.) H.P.Linder, T 8544, 10918, 11264*
nana *Esterh., T 11115, 12049, 12087*
ocreata *(Kunth) H.P.Linder, T 8458, 8487, 11915*
rivula *Esterh.*, Linder 1985
rottboellioides *(Kunth) H.P.Linder*, Oliver et al. 1983
setiger *(Kunth) H.P.Linder*, Linder 1985, U
sieberi *(Kunth) H.P.Linder, T 10909, 10926, 11012*
unispicata *H.P.Linder, T 10655, 10769, 11391a, 11660, 11858*
virgea *(Mast.) H.P.Linder, T 5090, 8464, 11313*
wallichii *(Mast.) H.P.Linder*, Oliver et al. 1983
Platycaulos compressus *(Rottb.) H.P.Linder, T 11745*
Restio
arcuatus *Mast.*, Oliver et al. 1983
brachiatus *(Mast.) Pillans*, Oliver et al. 1983
brunneus *Pillans, T 8462a, 10560, 12238*, R
confusus *Pillans*, Oliver et al. 1983
cymosus *(Mast.) Pillans, T 8463a, 11059*
distichus *Rottb.*, Oliver et al. 1983
filiformis *Poir., T 10591, 10692, 10977, 11059, 11070, 11475*
insignis *Pillans*, Oliver et al. 1983
miser *Kunth*, Oliver et al. 1983
occultus *(Mast.) Pillans, T 11040, 11168*
patens *Mast., T 8455, 10689, 11032, 11751*
pedicellatus *Mast., T 5104, 11133*
perplexus *Kunth, T 11688, 11851, 12041, 12044, 12048, 12052*
praeacutus *Mast.*, Oliver et al. 1983
quinquefarius *Nees*, Linder 1985
strobilifer *Kunth, T 5094, 5125, 6825, 10632*
triticeus *Rottb.*, Oliver et al. 1983
tuberculatus *Pillans*, Oliver et al. 1983, U
Rhodocoma capensis *Nees ex Steud.*, Oliver et al. 1983
Staberoha
aemula *(Kunth) Pillans, T 6830, 10852*

Staberoha (cont.)
cernua *(L.f.) T.Durand & Schinz*, Linder 1985
distachyos *(Rottb.) Kunth*, Linder 1985, Oliver et al. 1983
ornata *Esterh.*, Linder 1985
vaginata *(Thunb.) Pillans, T 7445*
Thamnochortus
acuminatus *Pillans, T 5102, 10691*
bachmannii *Mast., T 10624, 11876*
platypteris *Kunth, T 10724, 11291, 11328, 11596*
schlechteri *Pillans, T 8534*
Willdenowia
arescens *Kunth, T 7490, 10707, 10716, 10721, 11051, 11383, 11470, 11756*
glomerata *(Thunb.) H.P.Linder, T 8459, 8533, 10617, 11247, 11362*
humilis *Mast.*, Linder 1985
incurvata *(Thunb.) H.P.Linder, T 10627, 10966, 11214*
stokoei *Pillans, T 5107, 11649, 11764, 11778*
sulcata *Mast., T 5130, 11699*

TECOPHILAEACEAE
Cyanella hyacinthoides *L.*, Forestry 1984

XYRIDACEAE
Xyris capensis *Thunb., T 10837*

ANGIOSPERMAE–DICOTYLEDONAE

AIZOACEAE
Acrosanthes
anceps *(Thunb.) Sond.*, Adamson 1959
angustifolia *Eckl. & Zeyh., T 6197, 7487a, 11189, 11220, 11733*
humifusa *(Thunb.) Sond., T 11231, 11613*
microphylla *Adamson*, Bond & Goldblatt 1984
Adenogramma
glomerata *(L.f.) Druce, T 10660*
lichtensteiniana *(Schult.) Druce*, Bond & Goldblatt 1984
mullugo *Rchb.f.*, Forestry 1984
Galenia africana *L.*, Bond & Goldblatt 1984, Taylor sight record Bakmakersfontein
Limeum africanum *L., T 10659*
Pharnaceum
dichotomum *L.f.*, Forestry 1984
elongatum *(DC.) Adamson, T 11338*
incanum *L., Esterhuysen 12052, 21917*
lanatum *Bartl., Emdon 113*
rubens *Adamson*, Bond & Goldblatt 1984
serpyllifolium *L.f.*, Bond & Goldblatt 1984
Polpoda capensis *Presl*, Bond & Goldblatt 1984
Psammotropha
anguina *Compton, T 10481, 10699*
diffusa *Adamson*, Bond & Goldblatt 1984
frigida *Schltr., T 12262*
quadrangularis *(L.f.) Fenzl, Kruger 923, T 7448, 11166*
Tetragonia
fruticosa *L., G.J.Lewis 4173*
hirsuta *L.f., T 11336*
nigrescens *Eckl. & Zeyh., T 10991, 11336a*
rosea *Schltr., T 10940*
saligna *Fenzl, T 12122*

ANACARDIACEAE
Heeria argentea *(Thunb.) Meisn.*, PRECIS 1990
Rhus
angustifolia *L., T 7532*
cuneifolia *L.f., T 11182*
dissecta *Thunb., T 755, 1643, 5068*
incisa *L.f., T 10574*
rimosa *Eckl. & Zeyh., T 1642, 8448, 10739, 11251*
rosmarinifolia *Vahl, T 10786*
scytophylla *Eckl. & Zeyh., T 1644, 1652, 8457, 9342*
tomentosa *L., T 11450*
undulata *Jacq., T 5073*

APIACEAE
Anginon paniculatum *(Thunb.) B.L.Burtt, T 11271*
Annesorrhiza sp., *T 11492*
Arctopus echinatus *L., T 5099*
Centella
affinis *(Eckl. & Zeyh.) Adamson, T 11731*
fusca *(Eckl. & Zeyh.) Adamson, Esterhuysen 18015, 18159, 18175*
glabrata *L., T 7503*
lasiophylla *Adamson*, Bond & Goldblatt 1984
linifolia *(L.f.) Drude, T 11357, T 11412*
cf. recticarpa *Adamson, T 11811, 11884*
cf. restioides *Adamson, Stirton & Zantovska 11496*
scabra *Adamson, T 5070, 5087, 8499*
cf. sessilis *Adamson, Stirton & Zantovska 11480*
villosa *L., T 11691, 11813, 11866*
virgata *(L.f.) Drude, Stirton 11632*
sp., *T 6138*
Conium sphaerocarpum *Hilliard & B.L.Burtt, Esterhuysen 18107*
Hermas
ciliata *L.f.*, Taylor sight records, Sneeuberg
gigantea *L.f.*, PRECIS 1990
intermedia *C.Norman*, Bond & Goldblatt 1984
Itasina filifolia (Thunb.) Raf., *T 11870, 11886*
Lichtensteinia trifida *Cham. & Schltdl.*, Taylor fragment coll. Kliphuis gully
Peucedanum
multiradiatum *Drude, T 11024*
sonderi *(Hiroe) B.L.Burtt, T 10740, 11024*
strictum *(Spreng.) B.L.Burtt, T 11227, 12027*
Polemanniopsis marlothii *(H.Wolff) B.L.Burtt, T 11268, 11448, 11729, 11817*

AQUIFOLIACEAE
Ilex mitis *(L.) Radlk.*, Forestry 1984

ASCLEPIADACEAE
Asclepias
cancellata *Burm.f.*, Forestry 1984
crispa *P.J.Bergius, T 11931*
Cynanchum africanum *R.Br., Maguire 1025, Compton 19996*
Microloma
sagittatum *(L.) R.Br.*, PRECIS 1990, *T 11003*
tenuifolium *(L.) K.Schum.*, PRECIS 1990, *T 10790*
Secamone alpini *Schult.*, Forestry 1984
Stapelia
arenosa *C.A.Lück.*, Bond & Goldblatt 1984
cedrimontana *Frandsen*, Bond & Goldblatt 1984
erectiflora *N.E.Br., Compton et al. (NBG 1371/48), Rossouw 209, Wagener (NBG 218/43)*, R
grandiflora *Masson*, Bond & Goldblatt 1984
Tridentea parvipuncta *(N.E.Br.) L.C.Leach*, Bond & Goldblatt 1984

ASTERACEAE
Arctotheca calendula *(L.) Levyns*, PRECIS 1990
Arctotis
acaulis *L.*, PRECIS 1990
adpressa *DC., Compton 5070, 9585, Kerfoot 6149*
angustifolia *L., T 11399*
aspera *L., T 11743, 11906*
diffusa *Thunb., T 10756*
laevis *Thunb., T 10471, 10761*
oocephala *DC., Compton 9586*
pinnatifida *Thunb., T 11499*
semipapposa *(DC.) Beauverd, T 11159, 11585*
undulata *Jacq., L.E.Taylor 2920*
venusta *Norl.*, Forestry 1984
Athanasia
bremeri *Källersjö, T 7478, 10527*
calophylla *Källersjö, Esterhuysen 26886, T 11709*
flexuosa *Thunb., T 10771, 10933, 11169, 11680*
linifolia *Burm., T 11408*
microphylla *DC., Andrag 183, T 11256, 11524*
pachycephala *DC., T 10503, 10847, 11930, 12220, Viviers 813*
trifurcata *(L.) L., T 10772*
Athrixia crinita *(L.) Druce*, Bond & Goldblatt 1984
Atrichantha gemmifera *(Bolus) Hilliard & B.L.Burtt*, Bond & Goldblatt 1984
Berkheya
barbata *(L.f.) Hutch.*, PRECIS 1990
dregei *Harv., Andrag 78,* U
tysonii *Hutch., T 11933*
viscosa *(DC.) Hutch., Compton 20949*
Brachylaena neriifolia *(L.) R.Br.*, Bond & Goldblatt 1984, Taylor relevé 20
Bryomorphe lycopodioides *(Sch.Bip.) Levyns, Compton 6187, T 12261*
Castalis nudicaulis *(L.) Norl., T 8538, 10634, 11589*
Cenia turbinata *(L.) Pers., Maguire 244*
Chrysanthemoides monilifera *(L.) Norl., T 12174*
Chrysocoma
candelabrum *E.Bayer, Esterhuysen 2488, 30018*

Chrysocoma (cont.)
cernua *L., Esterhuysen 20521*
ciliata *L., T 11570, 11718*
cf. ciliata *L., T 11091*
longifolia *DC., Adamson D73*

Cineraria
alchemilloides *DC., Esterhuysen 18101*
canescens *Wendl. ex Link, Esterhuysen 18152*
erosa *(Thunb.) Harv., Viviers 812*
pedunculosa *DC.*, Bond & Goldblatt 1984

Conyza scabrida *DC., Wagener 310*

Corymbium
africanum *L., T 10903*
congestum *E.Mey. ex DC., Haynes 1275, Leipoldt 3664, Weitz 364*
glabrum *L., Andrag 200, Barker 857, Esterhuysen 17977, T 10903*
laxum *Compton, T 10892*
villosum *L.f., Weitz 356*

Cotula
barbata *DC., Compton 9536*
leptalea *DC.*, Forestry 1984
melaleuca *Bolus, Esterhuysen 8065, 12278*
montana *Compton, Esterhuysen 7325, 7548*

Cullumia
bisulca *(Thunb.) Less., T 11035*
ciliaris *(L.) R.Br., Maguire 1835*

Dicoma picta *(Thunb.) Druce*, Bond & Goldblatt 1984

Didelta spinosa *(L.f.) Aiton, T 10941*

Dimorphotheca
montana *Norl., T 11553*
pluvialis *(L.) Moench, Barker 6583*
sinuata *DC., Pocock 236*

Dolichothrix ericoides *(Lam.) Hilliard & B.L.Burtt, T 8450, 11740*

Edmondia pinifolia *(Lam.) Hilliard*, Bond & Goldblatt 1984

Elytropappus
adpressus *Harv., T 11513*
cyathiformis *DC., T 11424*
glandulosus *Less., T 11747*
gnaphaloides *(L.) Levyns, T 11469, 11736, 12073*
cf. gnaphaloides *(L.) Levyns, T 11188*
rhinocerotis *(L.f.) Less., T 12055*
scaber *(L.f.) Levyns, T 11746, 12026, 12032, 12056, 12066, 12068, 12070*

Eriocephalus
africanus *L., T 10566, 10963*
punctulatus *DC.*, Bond & Goldblatt 1984
sp., *Haynes 1379*

Euryops
abrotanifolius *(L.) DC.*, PRECIS 1990
brevilobus *Compton*, Bond & Goldblatt 1984, R
lateriflorus *(L.f.) DC., T 8526, 30.23*
multifidus *(Thunb.) DC., Compton 6911, Wagener 115*
othonnoides *(DC.) B.Nord., T 10964*
rehmannii *Compton, Esterhuysen 20455, Wagener 99*
speciosissimus *DC.*, Forestry 1984, *Taylor V1.74.1*
tagetoides *(DC.) B.Nord., Kruger 917*
tenuissimus (L.) *DC., T 10474, 10671*
thunbergii *B.Nord., Barker 6579*
wageneri *Compton, T 10670*

Felicia
aethiopica *(Burm.f.) Bolus & Wolley-Dod ex Adamson & T.M.Salter, T 7460*
amoena *(Sch.Bip.) Levyns*, Bond & Goldblatt 1984
australis *(Alston) E.Phillips, Esterhuysen 8064, Wagener 175*
bellidioides *Schltr.*, Bond & Goldblatt 1984
cymbalariae *(Aiton) Bolus & Wolley-Dod ex Adamson & T.M.Salter, T 5113, 6169, 11400, 11856*
diffusa *(DC.) Grau, T 11835*
dregei *DC., T 10572*
dubia *Cass., Esterhuysen 3290, 8137, 13135*
ferulacea *Compton, T 5121, 11075*
filifolia *(Vent.) Burtt Davy, T 7477, 10580, 11875*
hirsuta *DC., Esterhuysen 4394*
hispida *(DC.) Grau, T 11929*
merxmuelleri *Grau, Leipoldt (BOL 20793)*
minima *(Hutch.) Grau, Esterhuysen 13016, 20554*
scabrida *(DC.) Range, T 10662*
tenella *(L.) Nees, T 9317*

Gazania serrata *DC., T 10715*
Gorteria personata *L., T 9318*
Gymnodiscus capillaris *(L.f.) DC., T 11393*
Haplocarpha
lanata *(Thunb.) Less., T 12091*
parvifolia *(Schltr.) Beauverd, T 11084, 11099, 11555*
Helichrysum
acrophilum *Bolus, T 11693, 11913, 11927*
asperum *(Thunb.) Hilliard & B.L.Burtt, T 11722*
catipes *(DC.) Harv.*, Bond & Goldblatt 1984
cylindriflorum *(L.) Hilliard & B.L.Burtt, T 10736, 11410, 11658, 11916*
dasyanthum *(Willd.) Sweet, T 11131, 11354, 11609, 11832*
foetidum *(L.) Moench, T 12264*
hamulosum *E.Mey. ex DC.*, Bond & Goldblatt 1984
hebelepis *DC.*, Bond & Goldblatt 1984
helianthemifolium *(L.) D.Don, Compton 6185*
indicum *(L.) Grierson, T 11845*
lambertianum *DC., T 11962, 12246*
moeserianum *Thellung, T 11136, 11394, 11949*
odoratissimum *(L.) Sweet, T 11501, 12242*
scabrum *Less., T 11545, 11808*
stoloniferum *(L.f.) Willd., Pocock 196*
tinctum *(Thunb.) Hilliard & B.L.Burtt, T 7513, 11426*
tomentosulum *(Klatt) Merxm.*, Forestry 1984
zeyheri *Less., T 10947*
sp., *T 11812*
Heterolepis aliena *(L.f.) Druce, T 1840, 11437*
Hippia
frutescens *(L.) L., T 11078*
pilosa *(P.J.Bergius) Druce, T 5134*
Hirpicium alienatum *(Thunb.) Druce, Acocks 3215*
Hymenolepis
dentata *(DC.) Källersjö, T 10598, 11076, 11755*
parviflora *(L.) DC., C.C.P.Wagener s.n. (STE 26822)*
Hypochoeris
glabra *L.* *, Taylor relevé 150
radicata *L.* *, Taylor relevés 909–917
Ifloga ambigua *(L.) Druce, T 10984, 12054*
Lachnospermum
ericoides *Willd., T 11468*
fasciculatum *(Thunb.) Baill., T 10913*
Lamprocephalus montanus *B.Nord.*, Bond & Goldblatt 1984
Lasiopogon brachypterus *O.Hoffm. ex Zahlbr.*, PRECIS 1990
Leysera gnaphalodes *(L.) L., T 9323*
Lidbeckia lobata *Thunb., T 7447, 10720*
Mairia
ecklonis *(DC.) Sond.*, PRECIS 1990
lasiocarpa *DC., T 11038*
microcephala *(Less.) DC., T 10641*
perezioides *Nees, T 11322*
Metalasia
agathosmoides *Pillans, Andrag 245, Esterhuysen 22460*
albescens *Karis, T 11411*
densa *(Lam.) Karis, T 8536, 11407*
dregeana *DC., Herre (STEU 11443), Stokoe (SAM 61971), T 7497A*
fastigiata *(Thunb.) D.Don, T 10761, 11355, 11566, 11836*
Oedera
genistifolia *(L.) Anderb. & Bremer, Kruger 925, T 11611*
multipunctata *(DC.) Anderb. & Bremer, Kruger 916*
sedifolia *(DC.) Anderb. & Bremer, T 10885*
squarrosa *(L.) Anderb. & Bremer, T 11081*
Oligothrix gracilis *DC.*, Bond & Goldblatt 1984
Oncosiphon grandiflorum *(Thunb.) Källersjö*, Forestry 1984
Osteospermum
acutifolium *(Hutch.) Norl., T 8546, 10470, 10732*
bidens *Thunb., T 10714, 11419*
clandestinum *(Less.) Norl., Bolus 9042, Galpin 10729, T 9341*
connatum *DC., T 10482, 10596*
imbricatum *L.*, Forestry 1986
polygaloides *L.*, Forestry 1984
rigidum *Aiton, T 5066, 10472, 10599, 10780*
Othonna
alba *Compton, Acocks 20453*
amplexifolia *DC., T 1649, 10710, 10970*
arbuscula *(Thunb.) Sch.Bip., Leipoldt 1906*
auriculifolia *Licht. ex Less., T 10961*
coronopifolia *L., T 8527*
cuneata *DC., T 8469*
filicaulis *Jacq., T 10932*
gymnodiscus *(DC.) Sch.Bip., T 10985*

Othonna (cont.)
hcderifolia *B.Nord., T 10960*
humilis *Schltr.*, Bond & Goldblatt 1984
lobata *Schltr., T 10588, 11766*
multicaulis *Harv., T 8451, 11281*
obtusiloba *Harv., Esterhuysen 4882*
parviflora *P.J.Bergius, T 10501*
petiolaris *DC., T 10954, 10976*
ramulosa *DC.*, Forestry 1984
Polyarrhena imbricata *(DC.) Grau*, Bond & Goldblatt 1984
Printzia polifolia *(L.) Hutch., T 11349*
Pteronia
ambrariifolia *Schltr., T 11000*
camphorata *L., T 7479, 10778, 10887, 11350, 11882*
cinerea *L.f., T 11335*
divaricata *(P.J.Bergius) Less., T 11806*
fasciculata *L.f.*, Bond & Goldblatt 1984
utilis *Hutch., T 11662*
Relhania
calycina *(L.f.) L'Hér., T 11914*
corymbosa *(Bolus) Bremer, T 11117, 11639*
Senecio
albifolius *DC., T 11923*
amabilis *DC., T 11724*
angustifolius *(Thunb.) Willd., Meyer 8091*
arenarius *Thunb., T 11396, 11820, 11892*
burchellii *DC., T 11586*
cinerascens *Aiton, T 11043*
crassulifolius *(DC.) Sch.Bip., T 7525, 11367*
cymbalariifolius *(Thunb.) Less., T 11829*
eriobasis *DC.*, PRECIS 1990
erosus *L.f., T 8539, 11050*
glabrifolius *DC., T 10789*
grandiflorus *P.J.Bergius*, PRECIS 1990
cf. junceus *(DC.) Harv., T 30.43*
lanceus *Aiton, Rycroft 2670*
paniculatus *P.J.Bergius, T 7516, 10523, 10840, 11961*
parvifolius *DC., Esterhuysen 20475*
pinifolius *(L.) Lam., Barker 4503*
pinnatifidus *(P.J.Bergius) Less.*, Forestry 1984
pubigerus *L.*, Forestry 1984, *T 024.27*
repandus *Thunb., T 11796*
rosmarinifolius *L.f., T 10809*
sophioides *DC., Esterhuysen 12223*
tortuosus *DC., Esterhuysen 21734, Hugo 555*
tuberosus *(DC.) Harv., T 10711, 11620*
vestitus *P.J.Bergius, T 10893, 11840, 11864, 11954*
Stilpnogyne bellidioides *DC.*, Bond & Goldblatt 1984
Stoebe
aethiopica *L., T 7462*
capitata *P.J.Bergius*, Forestry 1984, Forestry 1986
fusca *(L.) Thunb., T 10919, 12040*
intricata *Levyns, T 12042, 12045, 12047, 12051, 12058, 12061, 12067, 12069, 12071*
leucocephala *DC., T 11253*
plumosa *(L.) Thunb., T 12059*
saxatilis *Levyns, T 11527, 12028*
spiralis *Less., T 11298*
Syncarpha
canescens *(L.) B.Nord., T 10962*
dregeana *(DC.) B.Nord., T 11094, 11236, 11416*
ferruginea *(Lam.) B.Nord.*, Forestry 1984
flava *(Compton) B.Nord., T 10532, 11282*
variegata *(P.J.Bergius) B.Nord., T 10705, 11083*
virgata *(P.J.Bergius) B.Nord., T 11420*
Troglophyton
elsiae *Hilliard*, PRECIS 1990
parvulum *(Harv.) Hilliard & B.L.Burtt*, PRECIS 1990
Ursinia
anthemoides *(L.) Poir., T 7510, 11842*
cakilefolia *DC., Leipoldt 20798, Lewis 3659*
chrysanthemoides *(Less.) Harv., T 11019*, R
macropoda *(DC.) N.E.Br., T 10864*
nana *DC.*, PRECIS 1990
nudicaulis *(Thunb.) N.E.Br.*, Bond & Goldblatt 1984
nudicaulis *(Thunb.) N.E.Br.* × U. palcacea *(L.) Moench, T 11418*
palcacea *(L.) Moench*, PRECIS 1990
pilifera *(P.J.Bergius) Poir., T 8541, 10701, 10993*
pinnata *(Thunb.) Prassler, T 10867, 10927*
punctata *(Thunb.) N.E.Br., T 10506, 10791, 11938*
rigidula *(DC.) N.E.Br.*, PRECIS 1990
sericea *(Thunb.) N.E.Br., T 10522, 10743*
subflosculosa *(DC.) Prassler, Esterhuysen 7150*, R

BORAGINACEAE
Anchusa capensis *Thunb., Wagener 186*
Lobostemon
echioides *Lehm., T 10764, 11348*
glaucophyllus *(Jacq.) H.Buek, T 5077, 7476, 11665, 11760*
hispidus *(Thunb.) DC., T 11353, 11572*
laevigatus *(L.) H.Buek, T 10570, 11587*
trichotomus *(Thunb.) DC., T 10469*

BRASSICACEAE
Brachycarpaea juncea *(P.J.Bergius) Marais, T 6155, 10504, 11121, 11209*
Cycloptychis
marlothii *O.E.Schulz, Esterhuysen 12716*
virgata *(Thunb.) E.Mey. ex Sond., T 11210, 11683, 11878*
Heliophila
africana *(L.) Marais, Hardy 802*
amplexicaulis *L.f., T 11578*
arenaria *Sond., Compton 6849*
arenosa *Schltr., Esterhuysen 20517*
carnosa *(Thunb.) Steud., T 10663*
cedarbergensis *Marais, Esterhuysen 30000*, R
cornuta *Sond., T 11805*
coronopifolia *L., Esterhuysen 13112*
crithmifolia *Willd., T 11843*
descurva *Schltr., Marais 1420*
digitata *L.f.*, Forestry 1984
dregeana *Sond., T 11118, 11511, 11584, 11619*
elata *Sond., Compton 6950, Esterhuysen 7179*
latisiliqua *E.Mey. ex Sond., Schlechter 8603*
namaquana *Bolus, Schlechter 8633*
pinnata *L.f., Schlechter 8636*
scoparia *Burch. ex DC., T 10600, 11079*
seselifolia *Burch. ex DC., Marais 1422, Schlechter 8811*
Lepidium trifurcum *(Sond.) Marais, T 11826*
Schlechteria capensis *Bolus, T 11368, 11617, 11754, 11904*

BRUNIACEAE
Berzelia
intermedia *(D. Dietr.) Schltdl.*, Oliver et al. 1983
lanuginosa *(L.) Brongn., T 8483, 10514*
squarrosa *(Thunb.) Sond.*, Oliver et al. 1983
Brunia nodiflora *L.*, Oliver et al. 1983
Lonchostoma
monogynum *(Vahl) Pillans*, Forestry 1984
pentandrum *(Thunb.) Druce, T 10693*
Nebelia paleacea *(P.J.Bergius) Sweet*, Bond & Goldblatt 1984
Pseudobaeckea
africana *(Burm.f.) Pillans, T 4478, 12245*
cordata *(Burm.f.) Niedenzu*, Oliver et al. 1983
Raspalia
dregeana *(Sond.) Niedenzu*, Bond & Goldblatt 1984, Oliver et al. 1983
palustris *(Schltr. ex Kirchn.) Pillans, T 11106*
staavioides *(Sond.) Pillans, T 7468, 11544*
villosa *Presl, T 11642*
Thamnea diosmoides *Oliv., T 11556*
Tittmannia laxa *(Thunb.) Presl, T 7849, 10511*

CAMPANULACEAE
Lightfootia
multicaulis *Adamson*, Bond & Goldblatt 1984, U
cf. spicata *H.Buek, T 10774, 10861, 11430, 11703*
sp., *T 11939*
Prismatocarpus
alpinus *(Bond) Adamson*, Forestry 1984
brevilobus *A.DC., T 11944*
cf. brevilobus *A.DC., T 11474*
decurrens *Adamson*, Bond & Goldblatt 1984, U
diffusus *(L.f.) A.DC., T 11207, 11744*
fruticosus *L'Hér., T 6192, 10495, 11506, 11689*
pauciflorus *Adamson*, Bond & Goldblatt 1984, U
sp., *T 10859*
Wahlenbergia
costata *A.DC.*, Forestry 1986, PRECIS 1990
decipiens *A.DC., Pillans 9062*
denticulata *(Burch.) A.DC.*, PRECIS 1990
ecklonii *H.Buek, T 6164, 11614, 11625, 11920*

Wahlenbergia (cont.)
meyeri *A.DC.*, Bond & Goldblatt 1984
oxyphylla *A.DC.*, Forestry 1984
pilosa *H.Buek*, PRECIS 1990
sphaerica *Brehmer*, Bond & Goldblatt 1984

CARYOPHYLLACEAE
Dianthus
albens *Aiton*, Forestry 1984
bolusii *Burtt Davy, Compton 6225*
thunbergii *Hooper*, PRECIS 1990
Silene
burchellii *Otth, T 11863*
clandestina *Jacq.*, Forestry 1986
undulata *Aiton, T 11809*
Stellaria media *(L.) Vill.*, T 11825*

CELASTRACEAE
Cassine peragua *L., T 8461, 8545, 10995, 11223, 11969*
Hartogiella schinoides *(Spreng.) Codd, T 10953, 10990, 11793, 11864*
Maytenus
acuminata *(L.f.) Loes., T 7455*
oleoides *(Lam.) Loes.*, Forestry 1984
Pterocelastrus tricuspidatus *(Lam.) Sond., T 11267, 11700*

CONVOLVULACEAE
Convolvulus capensis *Burm.f., T 11334*
Cuscuta nitida *E.Mey. ex Choisy, T 7488*

CRASSULACEAE
Adromischus maculatus *(Salm-Dyck) Lem., T 11720*
Cotyledon orbiculata *L.*, Bond & Goldblatt 1984
Crassula
alpestris *Thunb., Esterhuysen 3392, 20456*
aphylla *Schönland & Baker f., T 10882*
atropurpurea *(Haw.) D. Dietr, T 10804, 10805, 10845, 11675, 11708, 11850, 11941*
barbata *Thunb.*, Bond & Goldblatt 1984
cymosa *P.J.Bergius, T 11877*
decumbens *Thunb., T 11604*
dejecta *Jacq., T 10910, 11186*
dentata *Thunb., T 6171, 7528, 11112, 11422, 11855, 12082*
dichotoma *L.*, Forestry 1986
elsieae *Toelken*, Bond & Goldblatt 1984, R
fascicularis *Lam., T 11135*
filiformis *(Eckl. & Zeyh.) D.Dietr., T 11386*
glomerata *P.J.Bergius, Esterhuysen 22481*
lanceolata *(Eckl. & Zeyh.) Endl. ex Walp.*, Bond & Goldblatt 1984
lasiantha *Drège ex Harv., Esterhuysen 21311*
minuta *Toelken*, Bond & Goldblatt 1984
montana *Thunb., Toelken 1977*
muscosa *L., T 10950*
var. obtusifolia *(Harv.) G.D. Rowley, T 11721*
nudicaulis *L., T 11360*
obtusa *Haw., T 11902, 12089*
papillosa *Schönland & Baker f., T 5132*
pubescens *Thunb., T 11891, 11919*
pustulata *Toelken, T 11229*
rupestris *Thunb., T 11752, 11804*
saxifraga *Harv.*, Forestry 1984
sebaeoides *(Eckl. & Zeyh.) Toelken, T 11821*
subulata *L.*, Taylor relevé 144
tetragona *L., T 12043*
umbella *Jacq., T 11086, 11602*
umbellata *Thunb., T 5132*
sp., *T 84*
Tylecodon paniculatus *(L.f.) Toelken*, Taylor sight record Taaiboschkraal

CUNONIACEAE
Platylophus trifoliatus *(L.f.) D.Don, Kruger 910*

DIPSACACEAE
Scabiosa columbaria *L., T 11667*

DROSERACEAE
Drosera
alba *E.Phillips*, Bond & Goldblatt 1984
cistiflora *L., T 10700*
trinervia *Spreng., T 12079*

EBENACEAE
Diospyros
austro-africana *De Winter*, Bond & Goldblatt 1984
glabra *(L.) De Winter, T 10459*
ramulosa *(E.Mey. ex A.DC.) De Winter, Andrag 82, T 10939*
Euclea
acutifolia *E.Mey. ex A.DC., T 6196, 7497, 10602*
lancea *Thunb., T 10997, 11494, 11707, 12065*
linearis *Zeyh.ex Hiern, T 11968*
natalensis *A.DC.*, Forestry 1984
tomentosa *E.Mey. ex A.DC., T 11867*
tomentosa *E.Mey. ex A.DC.* × E. natalensis *A.DC., T 10958, 10959*

ERICACEAE
Arachnocalyx viscidus *(N.E.Br.) E.G.H.Oliv.*, Oliver et al. 1983
Coccosperma areolatum *N.E.Br., T 11648, 11921*
Eremia
calycina *Compton*, Oliver et al. 1983
curvistyla *(N.E.Br.) E.G.H.Oliv.*, Oliver et al. 1983
recurvata *Klotzsch, T 6133, 10513, 10897, 11999*
totta *(Thunb.) D.Don, T 6175, 11830, 12235*
Erica
aemula *Guthrie & Bolus*, Oliver et al. 1983
alnea *E.G.H.Oliv., Esterhuysen 30316*
arcuata *Compton, T 10930, 11288*
articularis *L., T 10912, 11287*
aspalathoides *Guthrie & Bolus*, Oliver et al. 1983, U
bergiana *L., T 10539, 12260*
bicolor *Thunb., T 11581*
breviflora *Dulfer, T 2305, 10505, 11670*
bruniades *L.*, Oliver et al. 1983
caffra *L., Andrag 291, Oliver 4022*
calycina *L., T 5133, 7470, 10788, 10825, 11109*
cederbergensis *Compton, Compton 6296, Esterhuysen 7550*
cerinthoides *L., Wagener 343*
cernua *Montin, T 5116, 10695, 11036, 11631*
chlamydiflora *Salisb.*, Oliver et al. 1983
coccinea *L., T 10508, 11897*
consobrina *Guthrie & Bolus*, Oliver et al. 1983
copiosa *Wendl.*, Oliver et al. 1983
corifolia *L.*, Oliver et al. 1983
cristiflora *Salisb., T 7461, 11125, 11369, 11603, 11690*
curviflora *L., T 10830, 10928, 11242*
daphniflora *Salisb., T 45, 6819, 6829, 10497, 10535*
denticulata *L.*, Oliver et al. 1983
distorta *Bartl.*, Oliver et al. 1983
doliiformis *Salisb.*, Oliver et al. 1983
eriocodon *Bolus*, Oliver et al. 1983
eugenea *Dulfer*, Oliver et al. 1983
flacca *E.Mey. ex Benth.*, Oliver et al. 1983
glauca *Andrews, T 11650*
gnaphaloides *L.*, Oliver et al. 1983
goatcheriana *L. Bolus*, Oliver et al. 1983
guthriae *Bolus, Kruger 940*
haematosiphon *Guthrie & Bolus, T 6177, 10881*
hispidula *L., T 11371*
hispiduloides *E.G.H.Oliv., Esterhuysen 34008*
humifusa *Hibbert ex Salisb.*, Oliver et al. 1983
imbricata *L.*, Oliver et al. 1983
incarnata *Thunb., T 1845, Kruger 930*
inflata *Thunb., T 44, 2304, 6170, 10509*
infundibuliformis *Andrews*, Oliver et al. 1983
involucrata *Klotzsch ex Benth., T 1848*
junonia *Bolus*, Oliver et al. 1983
lavandulifolia *Salisb.*, Oliver et al. 1983
leptopus *Benth., T 10857, 10865*
leucanthera *L.f., T 7472, 11129, 11180*
longipedunculata *Lodd., T 11184*
lucida *Salisb., T 10678, 11073, 11370*
lutea *P.J.Bergius, T 10894, 11481*
macrotrema *Guthrie & Bolus*, Oliver et al. 1983
maderi *Guthrie & Bolus, T 5109a, 5142, 7848*
mammosa *L.*, Oliver et al. 1983
maximiliani *Guthrie & Bolus, T 7852, 10777, Kruger 919*
monantha *Compton*, Oliver et al. 1983
monsoniana *L.f., T 5098*
nubigena *Bolus, T 6153, 11155*
nudiflora *L., T 6828, 11278, 11297*
oresigena *Bolus, T 1860, 7854, 10844, 12083*
palliiflora *Salisb., T 11114, 12225*

Erica (cont.)
parilis *Salisb., T 9589, 10857*
parviflora *L.*, Oliver et al. 1983
penicilliformis *Salisb.*, Oliver et al. 1983
philippioides *Compton*, Oliver et al. 1983
placentiflora *Salisb., T 5117, 10635, 11597, 11818*
plukenetii *L., T 11641*
pseudocalycina *Compton*, Oliver et al. 1983
pubescens *L.*, Oliver et al. 1983
pudens *H.A.Baker*, Oliver et al. 1983
quadrangularis *Salisb.*, Oliver et al. 1983
rubens *Thunb., T 7458, 10870, 11674, 11965, 12219, 12248*
selaginifolia *Salisb., T 11571*
senilis *Klotzsch ex Benth., Kruger 926, T 6163, 7452, 8548, 10475*
setociliata *H.A.Baker*, Oliver et al. 1983
sonderiana *Guthrie & Bolus*, Oliver et al. 1983
sphaerocephala *Wendl. ex Benth., T 11779*
subimbricata *Compton*, Oliver et al. 1983
tenuis *Salisb.*, Oliver et al. 1983
thunbergii *Montin, T 11616*
transparens *P.J.Bergius*, Oliver et al. 1983
tumida *Ker Gawl.*, Oliver et al. 1983
vanheurckii *Müll.Arg.*, Oliver et al. 1983
verecunda *Salisb., T 8481a, 11299, 11661*
sp. nov. (aff. argentea *Klotzsch ex Benth.*), *T 6159, 11294, 11634*
sp. nov. (= *Esterhuysen 22446*), *T 11643, 11924*
Grisebachia
ciliaris *(L.f.) Klotzsch, T 10484, 11025, 11607,* I
parviflora *(Klotzsch) Druce, T 5125a, 7459, 8471, 10683, 11033, 11057, 11311*
Salaxis
axillaris *(Thunb.) G.Don*, Bond & Goldblatt 1984
triflora *Compton*, Oliver et al. 1983
Scyphogyne
divaricata *(Klotzsch) Benth.*, Oliver et al. 1983, *T 104.13*
muscosa *(Aiton) Druce*, Oliver et al. 1983
urceolata *(Klotzsch) Benth., T 5095, 10971, 11049, 11156*
Simocheilus
albirameus *N.E.Br.*, Oliver et al. 1983
bicolor *(Klotzsch) Benth.*, Oliver et al. 1983
glaber *(Thunb.) Benth., T 033.6*
puberulus *(Klotzsch) E.G.H.Oliv., T 5119, 10593, 10664*

EUPHORBIACEAE
Clutia
alaternoides *L., T 10644*
polifolia *Jacq., T 5081, 5135, 6162, 7464, 7465, 11008, 10569*
polygonoides *L., T 10708, 11630, 11814*
pulchella *L., T 10987*
rubricaulis *Eckl. ex Sond., Compton 5395, Le Maitre 311*
sp. nov. (= *Marloth 11499*), *Esterhuysen 12265, T 7456, 10731, 11194*
Euphorbia
arceuthobioides *Boiss., Enudon 119*
burmannii *E.Mey. ex Boiss., T 9336*
erythrina *Link, T 94.24*
genistoides *P.J.Bergius, T 10652*
loricata *Lam., T 9295*
mauritanica *L.*, Taylor relevé 44
tuberosa *L., T 10975*
sp. (= *Andrag 85*), Forestry 1984

FABACEAE
Aspalathus
acifera *R.Dahlgren, Compton 6203, Dahlgren & Strid 4272, 4474*
acocksii *(R.Dahlgren) R.Dahlgren, Acocks 15045, Richardson 31*
acuminata *Lam.*, Oliver et al. 1983
altissima *R.Dahlgren, T 7530, 11105, 11149*
argyrella *MacOwan*, Oliver et al. 1983
arida *E.Mey., T 11425*
aristata *Compton, T 11910*
aurantiaca *R.Dahlgren, Compton 12480, Leighton 3343*
bidouwensis *Garab. ex R.Dahlgren*, Oliver et al. 1983
bodkinii *Bolus, T 7853, 10477, 10848, 11275*
bracteata *Thunb., T 6194*
brevicarpa *(R.Dahlgren) R.Dahlgren, T 11964, 12249*
ciliaris *L., T 10808, 11179*
comptonii *R.Dahlgren*, Bond & Goldblatt 1984
confusa *R.Dahlgren*, Oliver et al. 1983
costulata *Benth., T 10651, 11574*
crenata *(L.) R.Dahlgren*, Oliver et al. 1983
cuspidata *R.Dahlgren, T 11431, 11873*
decora *R.Dahlgren, T 6189, 10524, 11495,* U
dianthopora *E.Phillips, T 11810*
divaricata *Thunb., T 7514a, 11140, 11735, 11885*
esterhuyseniae *R.Dahlgren*, Oliver et al. 1983
filicaulis *Eckl. & Zeyh.*, Oliver et al. 1983
flexuosa *Thunb.*, Oliver et al. 1983
florulenta *R.Dahlgren*, Bond & Goldblatt 1984, U
galeata *E.Mey., T 7517, 11605, 11682*
galeata *E.Mey.*, X A, triquetra *Thunb., T 11573, 11621, 11652*
heterophylla *L.f.*, Oliver et al. 1983
hirta *E.Mey., T 10811*
hispida *Thunb., T 11940*
joubertiana *Eckl. & Zeyh., T 10673*
laeta *Bolus*, Bond & Goldblatt 1984
lanata *E.Mey., T 7496, 11734*
lanceifolia *R.Dahlgren, Compton 12706, Esterhuysen 18000*
lanifera *R.Dahlgren*, Bond & Goldblatt 1984
linearis *(Burm.f.) R.Dahlgren, T 11438, 11439, 11441*
nigra *L.*, Oliver et al. 1983
nudiflora *Harv., T 11728*
pendula *R.Dahlgren, T 11440*
perfoliata *(Lam.) R.Dahlgren*, Oliver et al. 1983, *T 10831, 11654*
pinea *Thunb.*, Oliver et al. 1983
polycephala *E.Mey., T 11562, 11624, 12234*
quinquefolia *L., T 11174, 11435, 11565*
retroflexa *L.*, Oliver et al. 1983
rupestris *R.Dahlgren*, Bond & Goldblatt 1984, Oliver et al. 1983
sericea *P.J.Bergius, T 10806*
spicata *Thunb.*, Oliver et al. 1983
spinosissima *R.Dahlgren*, Oliver et al. 1983
tridentata *L.*, Oliver et al. 1983, *T 6161, 7499, 10860, 11935*
triquetra *Thunb., T 10528, 10828*
uniflora *L., Bolus 8979*
villosa *Thunb., T 10869, 11816, 11958*
vulnerans *Thunb., T 10625*
wittebergensis *Compton & P.E.Barnes, T 11704*
Coelidium
cedarbergensis *Granby, T 5110, 10561, 11068, 11774*
perplexum *(Eckl. & Zeyh.) Granby, Granby 231*
purpureum *Granby*, Bond & Goldblatt 1984
villosum *(Schltr.) Granby, Bolus 5619, Esterhuysen 13077*
Cyclopia montana *Hofmeyer & E.Phillips, T 11072, 11629*
Dipogon lignosus *(L.) Verdc., T 11798*
Hypocalyptus sophoroides *(P.J.Bergius) Baill., T 11893*
Indigofera
adenoides *Baker f., T 7454*
amoena *Aiton, T 11002*
capillaris *Thunb., T 12094*
filifolia *Thunb.*, Forestry 1984
frutescens *L.*, Forestry 1984
gifbergensis *C.H.Stirt. & J.K.Jarvie, T 10868, 11847*
gracilis *Spreng., T 10784*
humifusa *Eckl. & Zeyh., T 11911*
cf. intermedia *Harv., T 11002*
psoraloides *(Presl) Benth., T 11879*
venusta *Eckl. & Zeyh., T 11346, 11559*
sp. indet., *Haynes 1368, T 117.8, 12252*
Lebeckia
carnosa *(E.Mey.) Druce, T 6193, 10877*
cytisoides *Thunb., T 11560*
grandiflora *Benth., T 11626*
longipes *Bolus, T 11633*
pauciflora *Eckl. & Zeyh., Le Maitre 260*
simsiana *Eckl. & Zeyh., T 11023*
Lessertia
capensis *(P.J.Bergius) Druce*, Bond & Goldblatt 1984
excisa *DC.*, Bond & Goldblatt 1984
herbacea *(L.) Druce, T 11138*
Lotononis
densa *(Thunb.) Harv., T 11569*
falcata *(E.Mey.) Benth., T 11803*
Otholobium
spicatum *(L.) C.H.Stirt.*, PRECIS 1990
striatum *(Thunb.) C.H.Stirt.*, PRECIS 1990, *D.E.Taylor s.n.*
trianthum *(E.Mey.) C.H.Stirt.*, PRECIS 1990
Podalyria
amoena *Eckl. & Zeyh., Leighton 1248*
leipoldtii *L.Bolus, Andrag 124, Esterhuysen 8138, T 11561*
pearsonii *E.Phillips, Le Maitre 536*

Priestleya
coriacea *Granby, Kruger 912, T 7527, 11925*
umbellifera *DC., T 1861, 6174, 11956*
sp., *T 10499*
Psoralea
aphylla *L.*, PRECIS 1990
fascicularis *DC., T 10876*
oligophylla *Eckl. & Zeyh., T 10519, 12034*
oreopola *C.H.Stirt., Pocock 418, T 6182, 11970a*
pinnata *L., T 10500, 10521, 10526*
tenuissima *E.Mey.*, Bond & Goldblatt 1984
verrucosa *Willd., T 12240*
spp. indet. (genus under revision), *T 10866, 11190, 11215, 11216, 11436, 11715*
Rafnia
amplexicaulis *Thunb., T 11097, 11258, 11432*
capensis *(L.) Druce, T 7506, 10516, 11295*
cuneifolia *Thunb., T 11917*
dichotoma *Eckl. & Zeyh., T 6201*
diffusa *Thunb., T 6136, 10754, 11098, 11145*
meyeri *Schinz, T 5931, 11254, 12237*
ovata *(P.J.Bergius) Schinz, T 11160*
perfoliata *E.Mey.*, Bond & Goldblatt 1984
retroflexa *Thunb., T 11483*
spicata *Thunb., T 7451, 11405, 11627*
sp., *T 11157*
Rhynchosia
bullata *Benth. ex Harv. & Sond., Esterhuysen 14990, Schlechter 8661, Stirton & Zantovska 11467*
cf. schlechteri *Baker f., T 11759*
sp., *T 11222*
sp. nov., *T 10785*
Spartium junceum *L.* *, *T 11737*
Sutherlandia frutescens *(L.) R.Br., T 10567*
Tephrosia capensis *(Jacq.) Pers., T 11580*
Wiborgia
fusca *Thunb., Hugo 651*
leptoptera *R.Dahlgren*, Bond & Goldblatt 1984
cf. monoptera *E.Mey., T 10946*
mucronata *(L.f.) Druce, T 11100*
obcordata *(P.J.Bergius) Thunb., T 10955*
sericea *Thunb., Bolus 8976*
tetraptera *E.Mey., T 10733*

FLACOURTIACEAE
Kiggelaria africana *L., T 7481, 10520*

FUMARIACEAE
Cysticapnos
cracca *(Cham. & Schltdl.) Liden, T 11827*
vesicarius *(L.) Fedde, T 11801*

GENTIANACEAE
Chironia
arenaria *E.Mey.*, Bond & Goldblatt 1984, Forestry 1984
baccifera *L., T 6832*
linoides *L., T 11217, 11225*
Sebaea
aurea *(L.f.) Roem. & Schult., T 6188*
exacoides *(L.) Schinz*, Forestry 1986
pusilla *Eckl. & Cham.*, Forestry 1984

GERANIACEAE
Erodium moschatum *(L.) L'Hér. ex Aiton *, Weintraub J19303, J19388*
Pelargonium
abrotanifolium *(L.f.) Jacq., Kruger 921*
alpinum *Eckl. & Zeyh.*, Bond & Goldblatt 1984
alternans *Wendl., T 11871*
angustifolium *(Thunb.) DC., Marais 268*
caespitosum *Turcz.*, PRECIS 1990, *Hugo 1201*
carnosum *(L.) L'Hér., Van der Walt 746*
chamaedryfolium *Jacq., Le Maitre 545, 618*
coronopifolium *Jacq., T 7450, 10766, 11087, 11096, 11414, 12253*
echinatum *(Thunb.) Curtis, T 5930, Wisura 1739*
ellaphiae *E.M.Marais, Marais 193, Van der Walt 1520*
englerianum *R.Knuth, T 6183, 10782, 11314, 11497, 11653, 12239, 12241*
gracilipes *R.Knuth, Leipoldt 517*
grandiflorum *(Andrews) Willd., T 11888*
laevigatum *(L.f.) Willd., Beyers 112, Van Wyk 1499*
leipoldtii *R.Knuth, Alice & Godman 575*
longicaule *Jacq., Baker 8132, Boucher 58*
longiflorum *Jacq., Le Maitre s.n. (STEU)*
longifolium *(Burm.f.) Jacq., Compton 16776, Lewis 1171*
magenteum *J.J.A. van der Walt, Davis (SAM 63206), Schonken 83*
myrrhifolium *(L.) L'Hér., Esterhuysen 3383, 20519, 20541, Hugo 430, 544, T 11588*
nanum *L'Hér., Esterhuysen 20518*
oenothera *(L.f.) Jacq., Pillans 9178, Van der Walt 744*
oreophilum *Schltr.*, Bond & Goldblatt 1984
pinnatum *(L.) L'Hér., Esterhuysen 25492*
proliferum *(Burm.f.) Steud., Esterhuysen 15015, 18166, 18172*
rapaceum *(L.) L'Hér., Compton 6253, Marais 196, T 11208*
scabrum *(Burm.f.) L'Hér., T 6198, 10467*
spathulatum *(Andrews) DC., T 11213*
sublignosum *R.Knuth, T 7500*
tabulare *(Burm.f.) L'Hér., T 7519*
triphyllum *Jacq., Esterhuysen 14338, 18020, 18111, T 11953*
triste *(L.) L'Hér., T 11857*
sp., *T 6203*
sp. (Hoarea), *T 10886, 10914*

GRUBBIACEAE
Grubbia rosmarinifolia *P.J.Bergius*, Bond & Goldblatt 1984

HALORAGACEAE
Gunnera perpensa *L.*, Forestry 1984, Taylor sight records
Laurembergia repens *P.J Bergius, T 12263*

LAMIACEAE
Mentha longifolia *(L.) L., T 10534, 11484*
Salvia
africana-caerulea *L., T 10626*
africana-lutea *L., T 11004, 11800*
albicaulis *Benth., T 6195, 7502, 10494, 11489*
chamelaeagnea *P.J.Bergius*, Codd 1985
dentata *Aiton*, Bond & Goldblatt 1984
lanceolata *Lam., T 10949*
Stachys
aethiopica *L.*, Bond & Goldblatt 1984
linearis *Burch. ex Benth., T 10466*
rugosa *Aiton, Emdon 164, Esterhuysen 8131, Schlieben & Van Breda 9884*

LENTIBULARIACEAE
Utricularia bisquamata *Schrank*, PRECIS 1990

LINACEAE
Linum
adustum *E.Mey. ex Planch., Lewis 1902*
comptonii *Rogers, Esterhuysen 2495*
pungens *Planch., T 6166, 11883*

LOBELIACEAE
Cyphia
bulbosa *(L.) P.J.Bergius, T 11029*
dentata *E.Wimm.*, Bond & Goldblatt 1984
digitata *(Thunb.) Willd., T 5122, 10590, 11015*
ranunculifolia *E.Wimm.*, Bond & Goldblatt 1984, R
volubilis *(Burm.f.) Willd., T 11831*
Laurentia arabidea *(Presl) A.DC., T 10898*
Lobelia
capillifolia *(Presl) A.DC., T 10805, 11212, 11932*
comptonii *E.Wimm.*, Bond & Goldblatt 1984
coronopifolia *L., T 11226*
erinus *L.*, Bond & Goldblatt 1984
esterhuyseniae *E.Wimm., Esterhuysen 21941*
humifusa *(A.DC.) P.B.Phillipson ined., T 10783*
linearis *Thunb., T 10805, 10814*
Monopsis
acrodon *E.Wimm., T 12092*
debilis *(L.f.) Presl*, PRECIS 1990
flava *(Eckl. & Zeyh.) E.Wimm., Stirton 10169, Thompson 167*, U

LOGANIACEAE
Buddleja
saligna *Willd.*, Taylor relevé 20, T 32.24, 32.129, 33.85
salviifolia *(L.) Lam., T 10999*

MALVACEAE
Anisodontea
bryoniifolia *(L.) D.M.Bates, Barker 780*
gracilis *D.M.Bates, Wagener 302*, U

MELIANTHACEAE
Melianthus major *L.*, Bond & Goldblatt 1984, Taylor sight records

MENISPERMACEAE
Cissampelos capensis *L.f.*, Forestry 1984

MESEMBRYANTHEMACEAE
Cephalophyllum loreum *(L.) Schwantes, Barker (NBG 2461/34)*
Conophytum
leipoldtii *N.E.Br., Esterhuysen s.n.*
minusculum *(N.E.Br.) N.E.Br., T 11485*
Diplosoma retroversum *(Kensit) Schwantes, Leipoldt s.n.*
Dorotheanthus
bellidiformis *(Burm.f.) N.E.Br., Van Jaarsveld 4326*
leipoldtii *L.Bolus, Leipoldt (BOL 18737)*
Erepsia
aspera *(Haw.) Schwantes, T 11249, 11681, 11692*
bracteata *(Aiton) Schwantes, T 84.18*
distans *L.Bolus, T 11238*
saturata *L.Bolus, T 11259*
sp., *T 11748*
Lampranthus
argenteus *(L.Bolus) L.Bolus, T 10768, 10884*
berghiae *(L.Bolus) L.Bolus, T 10622*
capillaceus *(L.Bolus) N.E.Br.*, PRECIS 1990
cedarbergensis *(L.Bolus) L.Bolus, T 11677*
comptonii *(L.Bolus) N.E.Br., T 7463, 11110, 11164, 11480, 11637*
edwardsiae *(L.Bolus) L.Bolus, T 11128*
guthrieae *(L.Bolus) N.E.Br., T 10668*
laetus *(L.Bolus) L.Bolus, T 10507, 10757, 10883, 11139, 11385, 11519*
lunatus *(Willd.) N.E.Br., T 8478*
lunulatus *(A.Berger) L.Bolus, T 10589, 11356, 11671*
macrostigma *L.Bolus, T 11250, 11266*
parcus *N.E.Br., T 11695*
scaber *(L.) N.E.Br., T 8479*
staminodiosus *(L.Bolus) Schwantes, T 10855*
thermarum *(L.Bolus) L.Bolus, T 11637*
tulbaghensis *(A.Berger) L.Bolus, T 10669*
sp., *T 11434*
Ruschia
(= Antimima) microphylla *(Haw.) Schwantes, T 11018*
aspera *L.Bolus, T 10994*
bina *L.Bolus, T 10647, 10677, 10956, 11063*
cedarbergensis *L.Bolus, T 10974*
dasyphylla *(Schltr.) Schwantes, T 10674, 11320*
decurrens *L.Bolus, T 11317, 11868*
dichroa *(Rolfe) L.Bolus, T 10727, 10972, 11165, 11315, 11753*
drepanophylla *(Schltr. & A.Berger) L.Bolus*, Bond & Goldblatt 1984
fredericii *(L.Bolus) L.Bolus, T 11413, 11592*
lapidicola *L.Bolus, Esterhuysen 12031, 21720*
lineolata *(Haw.) Schwantes, T 10478*
minutifolia *L.Bolus, H.Hall 2829*
pakhuisensis *L.Bolus, Bolus (BOL 20749)*
solida *(L.Bolus) L.Bolus, T 11676*
tardissima *L.Bolus, T 10579, 10980, 11363, 11493*
tumidula *(Haw.) Schwantes, T 8473*
sp., *T 8474, 11541*
Skiatophytum tripolium *(L.) L.Bolus, Viviers s.n.*

MONTINIACEAE
Montinia caryophyllacea *Thunb., T 10571*

MORACEAE
Ficus cordata *Thunb., T 372*

MYRICACEAE
Myrica
integra *(A.Chev.) Killick*, Bond & Goldblatt 1984
serrata *Lam.*, Bond & Goldblatt 1984

MYRSINACEAE
Myrsine africana *L.*, PRECIS 1990

MYRTACEAE
Metrosideros angustifolia *(L.) J.E.Sm.*, PRECIS 1990

OLEACEAE
Jasminum glaucum *(L.f.) Aiton, T 10578, 11205*
Olea
capensis *L.* subsp. capensis, Bond & Goldblatt 1984, Taylor sight records
europaea *L.* subsp. africana *(Mill.) P.S.Green*, Bond & Goldblatt 1984, Taylor sight records

OXALIDACEAE
Oxalis
adspersa *Eckl. & Zeyh., Leipoldt (BOL 19690)*
amblyosepala *Schltr., Leipoldt (BOL 18617, 21066)*
argillacea *F.Bolus, Leipoldt 426*
aridicola *T.M.Salter, Bayer 4802*
aurea *Schltr., Bayer 2818*
commutata *Sond., Bodkin (BOL 14582), Salter 6404, Weintroub (BOL 21867)*
dines *Ornduff*, Bond & Goldblatt 1984, U
dregei *Sond., Compton 9554*
ebracteata *Savign., Salter 733*
eckloniana *Presl, Barker 4486, Salter 8134*
flava *L., T 8494*
giftbergensis *T.M.Salter, Salter 2133, 8128, 8143*
gracilipes *Schltr., Leipoldt 294*
hirta *L., Leipoldt (BOL 19672)*
livida *Jacq., Salter 2135, 8140*
minuta *Thunb., Bolus 9400*
monophylla *L., Salter 4436, 8142*
obtusa *Jacq., T 11014, 11771, 11797, 12231*
oreophila *T.M.Salter, Salter 5397*, U
petiolulata *F.Bolus, Adamson (BOL 20492)*
phloxidiflora *Schltr., Schlechter 10797*
porphyriosiphon *T.M.Salter, Salter 2454, 5399*, U
recticaulis *Sond., Salter 3645*
stokoei *Weintroub, Salter 5084*
tenella *Jacq., Barker 4487, Salter 8139, T 10934*
uliginosa *Schltr., Bolus 20976*

PLUMBAGINACEAE
Limonium longifolium *(Thunb.) R.A.Dyer, T 10792*

POLYGALACEAE
Muraltia
acicularis *Harv.*, Oliver et al. 1983
alopecuroides *(L.) DC., T 6135, 11277, 11289*
angulosa *Turcz., T 11122*
brachyceras *Schltr., T 8485*
commutata *Levyns*, Oliver et al. 1983
crassifolia *Harv.*, Bond & Goldblatt 1984
heisteria *(L.) DC.*, Oliver et al. 1983
horrida *Diels*, Bond & Goldblatt 1984
lignosa *Levyns, Stokoe (SAM 54493)*
obovata *DC., T 8500*
pauciflora *(Thunb.) DC., Levyns 5815*
pillansii *Levyns*, Oliver et al. 1983
rhamnoides *Chod., T 5076, 8542, 10645, 10763, 11380, 11522*
scoparia *(Eckl. & Zeyh.) Levyns, Shaw (BOL 6036)*
sp., *T 12236*
Nylandtia spinosa *(L.) Dumort.*, Forestry 1984
Polygala
brachyphylla *Chod., T 5143a, 6202, 11908*
bracteolata *L.*, PRECIS 1990
garcinii *DC., T 11606*
lehmanniana *Eckl. & Zeyh., Esterhuysen 15369, 18164, T 5069*
ludwigiana *Eckl. & Zeyh.*, Bond & Goldblatt 1984
pappeana *Eckl. & Zeyh., Levyns 8116, 9362*
pedunculariis *Burch. ex DC., Pillans 7085*
refracta *DC.*, Bond & Goldblatt 1984

POLYGONACEAE
Persicaria serrulata *(Lag.) Webb & Moq., T 5072*
Rumex cordatus *Poir., Barnes s.n., Le Roux 2609*

PROTEACEAE
Aulax pallasia *Stapf, T 10537*
Brabejum stellatifolium *L.*, Bond & Goldblatt 1984, *T 29.34, 31.94, 32.18*
Leucadendron
arcuatum *(Lam.) I.Williams, T 6157, 10518*
bonum *I.Williams, T 7846*, E
brunioides *Meisn., T 11273*
concavum *I.Williams, T 10702*, R
dubium *(H.Buek ex Meisn.) E.Phillips & Hutch., Kruger 943, T 6156, 10480, 11926*
glaberrimum *(Schltr.) Compton, T 10658, 11344, 11594*
loranthifolium *(Salisb. ex Knight) I.Williams, Kruger 944, T 11340*
nitidum *H.Buek ex Meisn., T 1858, 1859, 10562, 10694, 10850, 11523*
procerum *(Salisb. ex Knight) I.Williams, T 11792*
pubescens *R.Br., Kruger 935, T 7505a*
rubrum *Burm.f.*, Oliver et al. 1983

Leucadendron (cont.)
salignum *P.J.Bergius, T 5084*
spissifolium *(Salisb. ex Knight) I.Williams, T 11520*
Leucospermum
calligerum *(Salisb. ex Knight) Rourke, T 10538*
catherinae *Compton*, Oliver et al. 1983, R
praemorsum *(Meisn.) E.Phillips*, Forestry 1984
reflexum *H.Buek ex Meisn.*, Oliver et al. 1983
spathulatum *R.Br., Kruger 934, T 7851, 11150, 11478, 11640*
tottum *(L.) R.Br., T 11183*
vestitum *(Lam.) Rourke, T 2307, 7475, 10801*
Paranomus
bracteolaris *Salisb. ex Knight, T 6180, 7522, 10458*
tomentosus *(E.Phillips & Hutch.) N.E.Br., T 6172,* R
Protea
acaulos *(L.) Reichard, T 5097, 10723, 10775, 10776*
acuminata *Sims, T 5140, 8491, 11521*
cryophila *Bolus, T 752, 6826*
cynaroides *(L.) L.*, Bond & Goldblatt 1984
glabra *Thunb.*, Bond & Goldblatt 1984
laevis *R.Br., T 5101a*
laurifolia *Thunb.*, Oliver et al. 1983
magnifica *Link*, Forestry 1984
nitida *Mill.*, Oliver et al. 1983
pendula *R.Br., T 10931, 11773*
piscina *Rourke*, Bond & Goldblatt 1984
punctata *Meisn., T 750, 6823*
recondita *H.Buek ex Meisn., T 11742*
repens *(L.) L.*, Bond & Goldblatt 1984
revoluta *R.Br.*, Bond & Goldblatt 1984
scolopendriifolia *(Salisb. ex Knight) Rourke, T 1847, 5100*
witzenbergiana *E.Phillips, T 5134, 6822*
Serruria
aitonii *R.Br., T 6176, 7446, 7847, 10476, 11085*
cygnea *R.Br., T 5078, 6134, 7482, 10832, 11120*
effusa *Rourke, T 11017, 11706*
flava *Meisn., T 5928, 8501, 10485,* R
fucifolia *Salisb. ex Knight*, Oliver et al. 1983
leipoldtii *E.Phillips & Hutch., T 10787, 11175, 11669,* R
millefolia *Salisb. ex Knight, T 10628*
Sorocephalus lanatus *(Thunb.) R.Br., Kruger 929, T 6158, 7850, 10512, 11107, 11628*
Spatalla
caudata *(Thunb.) R.Br.*, Oliver et al. 1983
confusa *(E.Phillips) Rourke, Kruger 937*
incurva *(Thunb.) R.Br., T 5111, 6167, 10502, 10684, 11108*

RANUNCULACEAE
Anemone tenuifolia *(L.f.) DC., T 11517*
Knowltonia vesicatoria *(L.f.) Sims*, Bond & Goldblatt 1984, Taylor sight record Leipoldt's Grave

RHAMNACEAE
Phylica
aemula *Schltr., T 5088, 10563, 11060*
alticola *Pillans*, Forestry 1984
altigena *Schltr.*, Bond & Goldblatt 1984, U
ambigua *Sond., T 6179, 7467, 8470, 10741, 12218*
barbata *Pillans*, Bond & Goldblatt 1984, U
barnardii *Pillans, T 7469, 11046, 11080*
constricta *Pillans*, Bond & Goldblatt 1984
cryptandroides *Sond., T 6817, 8502, 8524, 10734*
cylindrica *Wendl., Emdon 122, T 11191*
fruticosa *Schltr., T 11103, 11770,* R
hirta *Pillans, Diels 825*
imberbis *P.J.Bergius*, PRECIS 1990
insignis *Pillans*, Bond & Goldblatt 1984
leipoldtii *Pillans, T 10533, 11255, 11272,* U
marlothii *Pillans*, Bond & Goldblatt 1984
maximiliani *Schltr., Schlechter 8660,* U
nervosa *Pillans*, Bond & Goldblatt 1984
odorata *Schltr.*, Bond & Goldblatt 1984
oleifolia *Vent., T 1505, 8456*
plumigera *Pillans*, Bond & Goldblatt 1984, R
pulchella *Schltr., T 8498, 10637, 11342*
rigida *Eckl. & Zeyh., T 11104*
rigidifolia *Sond., T 6831, 8496, 10577, 10637, 10982*
spicata *L.f.*, Forestry 1984
stipularis *L., T 6818, 12030*
tuberculata *Pillans*, Bond & Goldblatt 1984
villosa *Thunb., T 5074, 6816, 7514, 10925, 11359, 11473*

RORIDULACEAE
Roridula dentata *L., T 8486, 11010*

ROSACEAE
Acaena latebrosa *Aiton, H.Bolus 8991*
Cliffortia
amplexistipula *Schltr.*, Bond & Goldblatt 1984
baccans *Harv., T 10661*
dregeana *Presl, T 6173, 10685*
hantamensis *Diels*, Bond & Goldblatt 1984
hexandra *Weim., T 11283, 11498*
neglecta *Schltr., T 8453, 11646*
cf. neglecta *Schltr., T 11645*
polygonifolia *L.*, Taylor relevé 75
propinqua *Eckl. & Zeyh., T 5123*
ruscifolia *L., T 10640*
sericea *Eckl. & Zeyh., T 11065*
strobilifera *Murray, T 33.29*
teretifolia *L.f., T 7515, 10642*
tricuspidata *Harv.*, Bond & Goldblatt 1984
triloba *Harv., T 7483, 10978, 11064*
tuberculata *(Harv.) Weim., T 5092, 10846*
uncinata *Weim., Pocock 737, T 6139, 11296*
Rubus rigidus *Sm., Pillans 9064*

RUBIACEAE
Anthospermum
aethiopicum *L., T 11026, 11152, 11406*
bergianum *Cruse, T 10687, 11389*
bicorne *Puff*, Puff 1986
comptonii *Puff*, Puff 1986
dregei *Sond.*, Puff 1986
esterhuysenianum *Puff*, Puff 1986
galioides *Rchb.f., T 11678*
hirtum *Cruse, T 7512*
spathulatum *Spreng.*, Puff 1986
Carpacoce
scabra *(Thunb.) Sond.*, Puff 1986, *Pocock 689*
vaginellata *T.M.Salter, T 7518, 11390*
Galium capense *Thunb., T 6184, 7485, 11507, 11610*
Nenax
coronata *Puff, Puff 800902-6/4*
divaricata *T.M.Salter, Esterhuysen 8145*

RUTACEAE
Acmadenia
bodkinii *(Schltr.) Strid, T 7473, 8454, 8466*
flaccida *Eckl. & Zeyh., T 5080, 7501, 10967*
macradenia *(Sond.) Dummer*, Bond & Goldblatt 1984, R
matroosbergensis *E.Phillips*, Bond & Goldblatt 1984
patentifolia *I.Williams*, Bond & Goldblatt 1984, R
rourkeana *I.Williams, T 10681*
teretifolia *(Link) E.Phillips, T 5089a, 6824, 11741*
Adenandra
marginata *(L.f.) Roem. & Schult., T 11351,* R
villosa *(P.J.Bergius) Licht. ex Roem. & Schult.*, Oliver et al. 1983
Agathosma
adnata *Pillans, T 10842, 11163,* R
aemula *Schltr., T 11095, 11554*
alpina *Schltr.*, PRECIS 1990
asperifolia *Eckl. & Zeyh., T 10969*
bathii *(Dummer) Pillans*, Bond & Goldblatt 1984
betulina *(P.J.Bergius) Pillans, T 11074, 11508, 11591*
bicolor *Dummer, T 10713, 11815,* R
bifida *(Jacq.) Bartl. & Wendl., T 10849*
bisulca *(Thunb.) Bartl. & Wendl., T 10581, 11421, 11732*
bodkinii *Dummer, T 7457*
capensis *(L.) Dummer, T 10775, 11048, 11119, 11161, 12251*
cedrimontana *Dummer, T 11429*
conferta *Pillans, T 10878,* R
craspedota *Sond.*, Bond & Goldblatt 1984
crassifolia *Sond.*, Bond & Goldblatt 1984
dentata *Pillans*, Bond & Goldblatt 1984, R
distans *Pillans, T 11854,* R
divaricata *Pillans, Kruger 913, T 11638, 11749*
dregeana *Sond.*, PRECIS 1990
esterhuyseniae *Pillans*, Bond & Goldblatt 1984
giftbergensis *E.Phillips, T 7486*
humilis *Sond., Esterhuysen 12146, 12211*

Agathosma (cont.)
juniperifolia *Bartl., Esterhuysen 13138*
krakadouwensis *Dummer, T 11144*
longicornu *Pillans, T 7505, 11047*
marlothii *Dummer, T 6168, 7531, 10824*
microcalyx *Dummer, T 10986*, Van Wyk 2552
odoratissima *(Montin) Pillans*, Bond & Goldblatt 1984
pattisoniae *Dummer*, Bond & Goldblatt 1984, U
peglerae *Dummer*, Forestry 1984
pubigera *Sond., T 8549, 11039, 11546, 11557*
rubricaulis *Dummer, T 11034*
salina *Eckl. & Zeyh. ex Pillans*, Bond & Goldblatt 1984, R
serpyllacea *Licht. ex Roem. & Schult., Levyns 2192*
sladeniana *P.E.Glover*, Bond & Goldblatt 1984
spinescens *Dummer, Bean 1350, Esterhuysen 14982*
squamosa *(Roem. & Schult.) Bartl. & Wendl.*, Bond & Goldblatt 1984
stilbeoides *Dummer, T 1648, 1862, 10888, 10901, 11739, 12232*
virgata *(Lam.) Bartl. & Wendl., Stokoe (SAM 68824)*
sp., *T 11016*

Coleonema juniperinum *Sond., T 11600*

Diosma
acmaeophylla *Eckl. & Zeyh., T 5120, 11316, 11526*
hirsuta *L., T 8525, 11623*
meyeriana *Spreng., T 10629, 11252, 11472, 11533, 11719*
pedicellata *I.Williams*, Oliver et al. 1983, U
ramosissima *Bartl. & Wendl., T 10577, 11467*
sp. near meyeriana *Spreng., T 10923, 11211, 11224, 11290, 11488, 11490*

Empleurum unicapsulare *(L.f.) Skeels, Andrag 91, Spreeth 103, Wagener 362*

Euchaetis
elsieae *I.Williams*, Oliver et al. 1983
ericoides *Dummer, Esterhuysen 13079, 18032*
esterhuyseniae *I.Williams*, Oliver et al. 1983, R
flexilis *Eckl. & Zeyh.*, Forestry 1984
glomerata *Bartl. & Wendl., T 5129, 6820a, 6833, 7488, 11062*
linearis *Sond.*, Forestry 1984

Macrostylis
decipiens *E.Mey. ex Sond., T 8468, 10922*
ramulosa *I.Williams, T 10620*, R
squarrosa *Bartl. & Wendl., T 8497, 10575, 10735, 11358, 11657, 11730*
tenuis *E.Mey. ex Sond., T 10862, 11428, 11528, 11705*

Phyllosma capensis *Bolus, Kruger 915, T 11102*

Sheilanthera pubens *I.Williams, Williams 2122*

SALICACEAE

Salix mucronata *Thunb., T 11799, 12038*

SANTALACEAE

Colpoon compressum *P.J.Bergius*, Bond & Goldblatt 1984, Taylor relevé 20

Thesium
aggregatum *A.W.Hill, Esterhuysen 12266, Leipoldt 3336, Levyns 7248*
capituliflorum *Sond., T 11943*
carinatum *DC., T 5108, 5143, 8476, 10558, 10665, 11361*
densiflorum *A.DC., T 10722*
ericifolium *A.DC., Esterhuysen 7340, 7489*
hispidulum *Lam., T 10621, 10725, 10762*
juncifolium *DC., T 7521*
macrostachyum *A.DC.*, Forestry 1984
nudicaule *A.W.Hill, T 10704, 10758*
orcsigenum *Compton, T 1647, 5091, 8452, 8476a*
prostratum *A.W.Hill*, Bond & Goldblatt 1984
pubescens *DC., T 5067, 7509*
selagineum *A.DC., T 5141*
spinulosum *A.DC., Le Maitre 523*
strictum *P.J.Bergius*, Bond & Goldblatt 1984, Taylor sight records Pakhuis Pass
subnudum *Sond., T 10759, 10989*
virgatum *Lam., T 5085*
sp. nov., *T 11819, 11824*

SAPINDACEAE

Dodonaea angustifolia *L.f., Andrag 54, Low 688*

SCROPHULARIACEAE

Alectra
sessiliflora *(Vahl) Kuntze*, PRECIS 1990
sp., *T 11950*

Bartsia trixago *L., T 11146*

Buchnera glabrata *Benth., T 11516*

Diascia
elongata *Benth., Steiner 2217*
gracilis *Schltr., Steiner 2218*
humilis *K.E.Steiner, Esterhuysen 20469*
sp., *Steiner 2025*
sp., 'long-spurred' (K.E.Steiner MS), *Steiner 715, 2014*

Freylinia lanceolata *(L.f.) G.Don, Metelerkamp 279*

Halleria
elliptica *Thunb., T 11192, 11970, 12025*
lucida *L., T 11487*
ovata *Benth., T 11794*

Harveya
bodkinii *Hiern, T 11696*
purpurea *Harv., T 12250*
squamosa *(Thunb.) Steud., Barker 1019*
sulphurea *Hiern, Compton 6893*

Hemimeris montana *L.f., T 11767*

Hyobanche
atropurpurea *Bolus, Levyns 2234, 2531*
sanguinea *L., Van Jaarsveld 4506*

Ixianthes retzioides *Benth., Andrag 302*

Limosella africana *Glueck, Pocock (PRE 41011)*

Manulea
adenocalyx *Hilliard*, Hilliard 1990
adenodes *Hilliard, Esterhuysen 23760*
altissima *L.f.*, Hilliard 1990
annua *(Hiern) Hilliard, Maguire 1811*
arabidea *Schltr.*, Hilliard 1990
cephalotes *Thunb.*, Hilliard 1990
decipiens *Hilliard*, Hilliard 1990
glandulosa *E.Phillips*, Hilliard 1990
juncea *Benth.*, Hilliard 1990
laxa *Schltr., T 11379*
leiostachys *Benth.*, Hilliard 1990
montana *Hilliard, L.E.Taylor 2964*
paucibarbata *Hilliard, Compton 6878, 7747, 7748*
pillansii *Hilliard*, Hilliard 1990
praeterita *Hilliard*, Hilliard 1990
rigida *Benth., T 10904*
virgata *Thunb.*, Hilliard 1990

Nemesia
bodkinii *Bolus, Kruger 931, T 11928*
cheiranthus *E.Mey. ex Benth.*, Forestry 1984
diffusa *Benth., T 10594*
ligulata *E.Mey. ex Benth., T 8540, 11387*
macroceras *Schltr.*, Forestry 1986
psammophila *Schltr., Thode A2129*
versicolor *E.Mey. ex Benth.*, Forestry 1984

Oftia africana *(L.) Bocquet*, Forestry 1984

Phyllopodium
caespitosum *Hilliard, Esterhuysen 20574*
cordatum *(Thunb.) Hilliard, Compton 7016*
micranthum *(Schltr.) Hilliard, Schlechter 8817*
pubiflorum *Hilliard, Esterhuysen 3363*

Polycarena
aemulans *Hilliard, Salter 7515*
aurea *Benth.*, PRECIS 1990
exigua *Hilliard, Esterhuysen 20575*
formosa *Hilliard, Lewis 3864*
gilioides *Benth., Compton 4773, 4991*
gracilis *Hilliard, Steyn 400*
leipoldtii *Hiern*, PRECIS 1990
rariflora *Benth., Esterhuysen 20538*
tenella *Hiern*, Bond & Goldblatt 1984

Sutera
aethiopica *(L.) Kuntze*, PRECIS 1990
caerulea *(L.f.) Hiern, Leipoldt (BOL 20218)*
decipiens *Hilliard, Esterhuysen 21745*
foetida *(Andrews) Roth*, Hilliard 1991
hispida *(Thunb.) Druce, T 132.43*
paniculata *Hilliard, T 10952*
subsessilis *Hilliard, Esterhuysen 18117*
uncinata *(Derouss.) Hilliard, Bos 616*
violacea *(Schltr.) Hiern, Middlemost 2032*

Teedia
lucida *Rudolphi, T 1863*
pubescens *Burch., Pocock 580, Thode A2129*

Trieenea
elsiae *Hilliard, Esterhuysen 13866*
glutinosa *(Schltr.) Hilliard, T 12088*
lanciloba *Hilliard, Pocock 653, T 11983, 12029, 12224, 12226*
lasiocephala *Hilliard, Esterhuysen 30016*
laxiflora *Hilliard, Esterhuysen 14972, T 7471*
schlechteri *(Hiern) Hilliard, T 7523, 12081*
taylorii *Hilliard, T 11401, 11894, Viviers 595*
Zaluzianskya
capensis *(L.) Walp., Viviers 347*
divaricata *Walp., Schlechter 8638*
glandulosa *Hilliard, Esterhuysen 21737*
peduncularis *(Benth.) Walp., Esterhuysen 20567*
pusilla *(Benth.) Walp., Esterhuysen 20549*

SELAGINACEAE
Agathelpis dubia *(L.) Hutch., T 10802, 11193*
Cromidon
microechinos *Hilliard, Esterhuysen 34399, 35073*
plantaginis *(L.f.) Hilliard, Esterhuysen 13089*
Dischisma ciliatum *(P.J.Bergius) Choisy, T 11398, 12002*
Gosela eckloniana *Choisy, T 6204, 10648, 11178, 11417*
Hebenstretia
lanceolata *(E.Mey.) Rolfe*, Bond & Goldblatt 1984
neglecta *Roessler, Leipoldt 560* (p.p.)
paarlensis *Roessler, T 11918*
robusta *E.Mey.*, PRECIS 1990
sp., *Kruger 1676*
Microdon
bracteatus *(Thunb.) Hartley, T 7466, 10646, 10829, 10879, 11132, 11181*
cylindricus *E.Mey., T 8480*
Selago
ascendens *E.Mey.*, Forestry 1984
brevifolia *Rolfe*, Forestry 1984
burmannii *Choisy*, Bond & Goldblatt 1984
glomerata *Thunb., T 10517, 11274*
glutinosa *E.Mey., T 10486, 10650, 11044*
guttata *E.Mey., T 11895, 11896*
heterophylla *E.Mey.*, Bond & Goldblatt 1984
hispida *L.f., Compton 9616*
lamprocarpa *Schltr. ex Rolfe, T 11415*
laxiflora *Choisy, T 10608, 10653*
minutissima *Choisy, T 10657*
oresigena *Compton*, Bond & Goldblatt 1984
ovata *Rolfe, T 11045*
rudolphii *(Hiern) Levyns, T 10755, 10839, 11276*
scabrida *Thunb., T 6187, 7492, 11881*
serrata *P.J.Bergius, T 10858, 11177*
spuria *L., T 10875, 11176*
stricta *P.J.Bergius, Lewis (BOL 22276), Welman 00150*
tephrodes *E.Mey.*, PRECIS 1990
triquetra *L.f., Johnson 523*
sp., *T 11942*

SOLANACEAE
Lycium spp. (genus under revision), *T 10614, 10944*
Solanum
retroflexum *Dunal, T 11757*
tomentosum *L., T 10583*

STERCULIACEAE
Hermannia
alnifolia *L., T 11345, 11352*
aspera *Wendl., T 10568, 10654, 10988, 12119*
cuneifolia *Jacq., T 10559*
denudata *L.f., T 7533, 10631*
diffusa *L.f., T 10623*
helicoidea *I.Verd., Pillans 9063*, R
multiflora *Jacq.*, Forestry 1984
odorata *Aiton, T 10672*
cf. prismatocarpa *E.Mey. ex Harv., T 11564*
rigida *Harv., De Winter & Verdoorn 9044, Oliver (STE 33288)*
scabra *Cav., T 5071, 7504, 10965, 11772*
sisymbriifolia *(Turcz.) Hochr., T 7524, 10597, 10712, 11007, 11532*
trifurca *L., T 11339*

STILBACEAE
Stilbe albiflora *E.Mey., T 10807, 11228*

THYMELAEACEAE
Gnidia
geminiflora *E.Mey. ex Meisn., T 5118, 10696*
oppositifolia *L., T 10498*
Lachnaea
capitata *(L.) Meisn., Leipoldt (STEU 25886)*
filamentosa *(Thunb.) Meisn., T 1613, 6154, 10675*
funicaulis *Schinz, T 11775*
globulifera *Meisn., T 10601, 10728, 10973*
laniflora *(C.H.Wright) Bond, T 5089, 6146, 10686, 10843*
marlothii *Schltr., T 5103, 6821*
naviculifolia *Compton, T 10510, 10676, 11058*
penicillata *Meisn., Forsyth 35*
striata *(Lam.) Meisn., Bolus 9087*
sp. nov., *T 10871*
Passerina
glomerata *Thunb., T 10483, 10618, 10841, 11154*
vulgaris *Thoday, T 11663, 11858*
sp., *T 12259*
Struthiola
ciliata *(L.) Lam., T 7498, 10638, 11061, 11403, 11567, 11761*
leptantha *Bolus, T 5079, 11761, 12072*
linearifloba *Meisn.*, PRECIS 1990
myrsinites *Lam., T 11116*

URTICACEAE
Didymodoxa capensis *(L.f.) Friis & Wilmot-Dear, T 11795*

VISCACEAE
Viscum pauciflorum *L.f., T 11486, 11839, 12000*

ZYGOPHYLLACEAE
Seetzenia lanata *(Willd.) Bullock, Bodkin (Bolus 8931), Goldblatt 5652*
Zygophyllum
flexuosum *Eckl. & Zeyh.* (?), *T 10639* (genus under revision)
foetidum *Schrad. & Wendl., Boucher 3091*
fulvum *L., Bos 3018, Compton 6924, Esterhuysen 20504, Wagener 158*
morgsana *L., Leipoldt 878*
pygmaeum *Eckl. & Zeyh., T 11427*
sessilifolium *L.* (?), PRECIS 1990 (genus under revision)
sonderi *H.Eichler* (?), *Pocock 699* (genus under revision)

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A. Diagnostic species for Community 1																										
Brabejum stellatifolium	5																									
Prionium serratum	4																									
Platycaulos compressus	4																									
Freylinia lanceolata	3																									
Phragmites australis	3																									
Imperata cylindrica	2																									
Cliffortia strobilifera	2																									
Rhus angustifolia	2																									
Juncus lomatophyllus	2																									
Psoralea oreopola	2																									
B. Species common to Communities 2 & 3																										
Pteridium aquilinum	4	4												1												
Elegia capensis	1	5																								
Berzelia lanuginosa	1	2										2														
Psoralea pinnata		4																								
C. Species common to Communities 2 & 3																										
Todea barbara		4	3																							
Halleria lucida		4	3																							
Blechnum sp. (188.7)		4	1																							
D. Species common to Communities 1, 2 & 3																										
Metrosideros angustifolia	5	5	5																							
Brachylaena neriifolia	5	4	3																							
Calopsis paniculata	5	4	2																							
Erica caffra	3	2	2																							
Myrica serrata	1	4	2																							
Buddleja salviifolia	1		1																							
E. Diagnostic species for Community 4																										
Euclea acutifolia				4				1						1												
Melianthus major				3																						
Rhus tomentosa	1	2		3				1						1												
Euclea lancea				2																						
Anisodontea bryoniifolia				2		1																				
Viscum pauciflorum				2																						
Stachys aethiopica				1																						
Knowltonia vesicatoria				1																						
Ehrharta sp.				1										1												
F. Species common to Communities 3 & 4																										
Olea europaea subsp. *africana*			5	5																						
Chironia baccifera			2	5				1			1		2	1												
Hartogiella schinoides			5	4	1																					
Secamone alpini		2	4	4																						
Euclea natalensis			1	4																						
Diospyros austro-africana			1	3																						
Protasparagus retrofractus			1	3																						
Kiggelaria africana			1	2																						
Senecio vestitus			3	2							+															
Myrsiphyllum kraussianum			2	1	1									1												
Colpoon compressum			1	1																						
Lidbeckia lobata			1	1										1												
Protasparagus aethiopicus			2	1																						
Solanum tomentosum			1	1																						
Zantedeschia aethiopica			1	1																						
Crassula decumbens			1	1																						
Hemimeris montana			1	1																						
G. Species common to Communities 1, 2, 3 & 4																										
Clutia pulchella	4	5	2	2																						
Rhus undulata	1	2	3	5		1		1						1				+								
Podocarpus elongatus	1	4	4	2																						
Cassine peragua		2	2	3																						
Indigofera frutescens		2	2	2										1				+								
H. Diagnostic species for Community 5																										
Aloe mitriformis					1	3																				
Ruschia decurrens						4		2																		
Conophytum minusculum						3																				
Crassula rupestris						2																				
Albuca cooperi						2																				
Ornithogalum cf. *conicum*						2																				

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
I. Diagnostic species for Community 6																										
Lampranthus cedarbergensis						4																				
Ruschia solida						3												+				2				
Cannomois taylorii					1	1																				
J. Species common to Communities 5 & 6																										
Crassula atropurpurea					5	5				2	+	2		1												
Ruschia dasyphylla					4	4																				
Protea glabra					4	4																				
Pelargonium alternans					4	3																				
Adromischus maculatus					4	2				2																
Euphorbia loricata					3	2																				
Aspalathus polycephala					1	4					+															
K. Species common to Communities 3, 4, 5 & 6																										
Heeria argentea		2	5	4	4	5					1		2		2											
Protasparagus suaveolens			1	2	5	3	2							1												
Rhus rimosa			1	3	1	5									2											
Clutia polifolia			1	3	1	1																				
Crassula atropurpurea var. *watermeyeri*			1	1		1																				
L. Diagnostic species for Community 7																										
Macrostylis sguarrosa							4	1										+								
Aspalathus hirta							3																			
Erica verecunda							3																	2		
M. Species common to Communities 5, 6 & 7																										
Restio perplexus					3	5	5																			
Crassula dejecta			1		5	3	2							1												
O. Diagnostic species for Community 8																										
Elytropappus rhinocerotis								5																		
Ehrharta bulbosa/capensis								4										1								
Athanasia trifurcata								4																		
Protasparagus rubicundus				1				3																		
Elytropappus cf. *gnaphaloides*								2										+								
Nylandtia spinosa					1			2																		
Arctopus echinatus							2	2					2													
Printzia polifolia								2																		
Senecio rosmarinifolius								2																		
Erepsia saturata								2																		
Salvia albicaulis								2										1								
Aspalathus lanata								2																		
Ficinia brevifolia								1																		
Crassula sp. (84.7)								2																		
Wiborgia tetraptera								1																		
Ornithogalum thyrsoides								1																		
P. Species common to Communities 5, 6, 7 & 8																										
Cheilanthes contracta				1	3	4	2	2						1												
Merxmuellera arundinacea						1	4	2																		
Thunbergiella filiformis					1			1																		
N. Species common to Communities 1, 3, 4, 5, 6, 7 & 8																										
Phylica oleifolia	1		1	5	3	5	5	2			1				2				2	2						
Dodonaea angustifolia	3		1	1	1	2		4						1				+		2						
Q. Species common to Communities 5, 6, 7 8 & 9																										
Anthospermum galioides					3	4		2	2		+						1		2							
Euryops speciosissimus					3			1	5		+															
Phylica rigidifolia							2	1	4		+			1												
R. Diagnostic species for Community 10																										
Dolichothrix ericoides										4																
Mesembryanthemaceae sp. (11672)										5																
Othonna retrofracta										4																
S. Diagnostic species for Community 11																										
Widdringtonia cedarbergensis										2	3															
Stoebe aethiopica						1					3		2					+			3					
Ischyrolepis ocreata											1													2		
Restio patens											1				1											
Erica parilis											1															
Pentameris dregeana											1			1												
Stoebe saxatilis											1						1									
Cliffortia triloba											1															

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
S. Diagnostic species for Community 11 continued																										
Simocheilus glaber											1															
Erica calycina											1			1												
Paranomus tomentosus											1															
T. Species common to Communities 5, 6, 7, 8, 9, 10, 11 & 12																										
Passerina glomerata					5	5	4	4		2	2	4														
Eriocephalus africanus					5	3	3	4	5	4	3	2		1			1	+								
Diosma acmaeophylla				1	4	4			4	4	1	2								2						
Oedera sedifolia					4	1			4	5	1	2														
Lampranthus lunulatus						5				4		3														
Felicia filifolia					1	1	2	1			2															
Phylica fruticosa					2	1					2															
Indigofera filifolia					2						1			1												
Senecio crassulifolius					3					4																2
Helichrysum scabrum					1						+															
U. Diagnostic species for Community 13																										
Cliffortia hexandra													5													
Erica placentiflora													5								5					
Crassula sebaeoides													5													
Silene undulata											+		5	1												
Thesium sp. nov. (11819)													5	1												
Microloma tenuifolium													5	1												
Tephrosia capensis													4	1												
Selago spp.													5													
Erepsia sp. (11828)													5													
Sebaea sp.													4													
Microdon bracteatus													4													
V. Diagnostic species for Community 14																										
Cheilanthes induta			1	1							+			3												
Manulea cephalotes														2												
Psoralea oligophylla											+			2												
Pteridophyta spp.								1						2												
Senecio pubigerus														2										2		
Osteospermum connatum														1												
Senecio pinnatifidus (34.32)											1			1												
Rhus rosmarinifolia														1												
W. Species common to Communities 13 & 14																										
Protasparagus compactus											+		5	4												
Othonna parviflora											+		2	2												
Galium capense											+		2	2												
Pelargonium tabulare													2	1												
Felicia diffusa													2	1												
X. Species common to Communities 11, 13 & 14																										
Selago serrata											1		4	1												
Cullumia bisulca							2				1			2												
Hermannia sisymbriifolia											1			1					2							
Pelargonium englerianum							2		2		1	2		1												
Senecio paniculatus											1			1			1									
Senecio tuberosus											+		4	1												
Senecio burchellii											1			1												
Crassula pubescens											+			1												
Y. Species common to Communities 8, 9, 10, 11, 13 & 14																										
Protea nitida								3	2		1		5	5				+								
Osteospermum rigidum								1			1		4	3			1									
Montinia caryophyllacea							2	2					4	1												
Centella lasiophylla								1			+			2	2											
Crassula fascicularis								1	2		+			2							3					
Pentaschistis malouinensis								2						2												
Tribolium uniolae								1	4					1										2		
Selago scabrida								1						1												
Watsonia marginata					1			1						1												
Helipterum virgatum								1						1												
Z. Species common to Communities 8, 9, 10, 11, 13, 14 & 15																										
Ischyrolepis gaudichaudiana				1				2	4		2		5	5	5											

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
AA. Species common to Communities 5 to 15																										
Ficinia nigrescens				1	5	5	4	2	5	4	4	2	5	5	2		1	1								
Pentaschistis eriostoma					4	2	2	2		2	3	4		3	4	1	1							2		
Phylica ambigua						1	4				2			1	2	1										
Campanulaceae spp.										4	1		5					1								
Ursinia sericea						1	2				1			1		2								2		
AB. Species common to Communities 4 to 15																										
Lobostemon glaucophyllus				2			4	1			+		2	4				1								
Rhus scytophylla			1	2	3	2					2			1	3											
Peucedanum sonderi				2									2													
AC. Species common to Communities 1 to 15																										
Maytenus oleoides		2	4	5	2	2		1			1		4	3	2											
Diospyros glabra	2	4	5	4		1		1			1		2	3	3											
Myrsine africana	1		1	5	1						1		4	1												
Ficinia acuminata			1	3		2					+		5	3												
AD. Diagnostic species for Community 16																										
Tetraria triangularis																4										
Agathosma stilbeoides																2										
AE. Species common to Communities 11 to 16																										
Ehrharta ramosa			2	1	1		2				2	2	2	3	4	4	1									
AF. Diagnostic species for Community 17																										
Leucadendron glaberrimum																	4									
Athanasia microphylla																	4									
Aspalathus triquetra														1			2		2				2			
Protea acuminata											+						2									
Ruschia lineolata								1									2									
Andropogon appendiculatus																	1							2		
Muraltia alopecuroides																	1									
Athanasia bremeri																	1									
Indigofera sp. (11909)																	1									
Cliffortia baccans								1									1									
AG. Species common to Communities 11, 13, 14 & 17																										
Clutia alaternoides										2			5	5	3		2									
Elytropappus adpressus									4	1				2			5									
Pelargonium laevigatum										2				3			1									
Scabiosa columbaria										1			4	2			1	+								
Othonna auriculifolia									2	1				2			2									
Pentameris macrocalycina										1		2	4	1			1									
Castalis nudicaulis										1			5	1			1	+								
Phylica leipoldtii										1							1									
Selago glomerata										1		3					1									
Aspalathus galeata										+							1	+								
Agathosma divaricata										+							1									
AH. Species common to Communities 8, 9, 11, 13, 14 & 17																										
Oedera squarrosa								2	5	1				1			1									
Helichrysum dasyanthum						1		3		1		2		1			1									
Agathosma capensis								4						1			1									
Festuca scabra								3					5	1			1									
AI. Diagnostic species for Community 18																										
Thamnochortus platypteris										+							1	5				2				
Aristea dichotoma						1												3								
Tetraria compar																		3								
Ischyrolepis monanthos																		3								
Ficinia bulbosa																	1	3								
Metalasia fastigiata							2											3		2						
Rafnia diffusa																	1	2								
Protea acaulos																		2								
Leucadendron salignum								1										2								
Athanasia flexuosa																		2								
Osteospermum acutifolium													4					2								
Willdenowia incurvata								2										2								
Thesium hispidulum								1									1	1			3					
Stoebe leucocephala																	1	1								
Psammotropha anguina																		1								
Eriospermum lanuginosum																		1								
Ficinia indica								1	2									1								

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
AI. Diagnostic species for Community 18 continued																										
Pharnaceum incanum								1										1								
Lachnospermum fasciculatum																		1								
Lobelia coronopifolia																		1								
Syncarpha canescens																		1								
Dischisma ciliatum																		1								
Serruria aitonii																		1								
Gosela eckloniana																		1								
Stipagrostis zeyheri																		1								
Pentaschistis aristidoides																		1								
Anthospermum bergianum																		1								
Ursinia pilifera																		1								
Helichrysum moeserianum					1													1								
Moraea spp.																		1								
Aspalathus vulnerans							2											1								
Adenogramma glomerata													2					1								
Grisebachia ciliaris																		1								
AJ. Species common to Communities 17 & 18																										
Muraltia rhamnoides																	2	1								
Arctotis diffusa														1			1	2								
Lobostemon echioides																	1	1								
Gymnodiscus capillaris																	1	2								
Selago spuria																	1	1								
AK. Species common to Communities 9 to 18																										
Manulea laxa																	1	+								
Ischyrolepis unispicata									4		+			1			5	2				2				
Gnidia geminiflora									5					2			4	2								
Pentaschistis viscidula											+			3				2								
Cymbopogon marginatus														2			1	2	2							
Senecio erosus													2	1		1	1	1								
Senecio arenarius													4	1				+								
AL. Species common to Communities 8, 11, 13, 14, 17 & 18																										
Merxmuellera stricta								2	2		1		4	3	2		3	2								
Lasiochloa longifolia							2	4	2		+		2	3			2	1								
Lampranthus laetus							2	1			2			2			1	3								
Ficinia dunensis								1			+						2	2								
Cliffortia polygonifolia								2							2			+								
AM. Species common to Communities 5 to 18																										
Thesium subnudum					1	3	2	2			1	2						3	2							
Chrysocoma ciliata				1			2	2	4				2	1			1	2								
Gazania serrata					1	1		1			+			1			3	1								
Pteronia camphorata					1	1		1		4	1	4						1								
Ruschia dichroa					5													2								
Pelargonium scabrum			1			2		1			+			1	2			1								
Cyphia digitata					2				2		+		2	1				+								
AN. Diagnostic species for Community 19																										
Elytropappus scaber																			5							
AO. Species common to Communities 18 & 19																										
Lightfootia cf. *spicata*								1									1	3	3							
Agathosma pubigera														1				1	5							
Diosma meyeriana					1		2						2				1	1	2							
Aspalathus linearis																		1	3							
AP. Species common to Communities 5 to 19																										
Ehrharta calycina/villosa				1	5	5	5	5	5		2		5	4			5	5	3		3					
Ischyrolepis sieberi					3	3	4	2		5	3	5		2	3	4		2	5						3	
Stoebe intricata					1	5	4	2			2			1			1	+	3							
Ruschia tardissima						2	3	1			+							1								
AQ. Species common to Communities 19 & 20																										
Hypodiscus neesii								2			+							+	5	2						
Selago lamprocarpa						1	3											+	5	4						
Lobelia capillifolia											+								3	2						
AR. Species common to Communities 18, 19 & 20																										
Tetraria nigrovaginata							2	1										4	3	4						
Pelargonium coronopifolium											+	2						3	2	2			2			
Macrostylis tenuis/decipiens											+			1	2		1	3	4	4						
Rafnia cuneifolia																		1	2	2						
Haplocarpha parvifolia												2						1		2						

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
AS. Species common to Communities 13, 14, 17, 18, 19 & 20																										
Willdenowia arescens											+		4	1			2	4	3	4						
AT. Species common to Communities 6 to 20																										
Helichrysum cylindriflorum						1	3	2	4		+		4	5			2	1	2	2						
Aspalathus divaricata							4	1										2		4						
Protea laurifolia						2		2	5		1							1	2	5						
AU. Diagnostic species for Community 21																										
Centella cf. *recticarpa* (11811)																		+			5					
Lachnaea globulifera																					5					
Bobartia rufa																					5					
Aspalathus sericea																					5					
AV. Species common to Communities 18, 19, 20 & 21																										
Elytropappus glandulosus								1					2	1			1	2		4	5	2				
Thesium nudicaule																		2	3		5					
Simocheilus puberulus											+							1	2		3					
AW. Species common to Communities 8 to 21																										
Tetraria cuspidata								2			4		4	2	3		4	2	5	5	5					
Corymbium africanum								3	4		+			3	2		2	2			5					
Ischyrolepis capensis								5	4									1		2	3					
Muraltia heisteria							3				2	3	2					1	4		3					
Pentaschistis curvifolia								2					2				1	1	4	2	3					
Ursinia punctata								1			2	2	5	1	2				2	4	3					
Tritoniopsis antholyza							2	2						1				1		4	3					
Lobostemon trichotomus								1			1						2	1	3	2	3					
Ficinia filiformis								1			1			1	2		1				5					
Phylica villosa								2			1							1	3	2						
Osteospermum bidens							2				1	2		1					2		5					
AX. Diagnostic species for Community 22																										
Staberoha aemula																						5	2		5	
Willdenowia sulcata															2		1	+				5				
Tetraria crinifolia																						5				
AY. Species common to Communities 11 to 22																										
Ficinia petitiana							2				1	3		1	2			2	3	2		2				
Prismatocarpus fruticosus											2	3		2	2		1	1	2	2	5	2				
Thesium strictum											1			2	2			+	3	2	3					
Dilatris ixioides											+							+	2	5	3	2				
Selago rudolphii																	1	1		2		2				
AZ. Species common to Communities 20 to 23																										
Elegia filacea											+	4					1	1		5	5	5	5			
BA. Species common to Communities 9 to 23																										
Cannomois parviflora							2		4	4	4	5		2	5	4	3	3	5	5	5	2	5	2		
Ficinia deusta							2	1	2		2		2	4	3		4	3	3	4	5		2			
Restio filiformis										2	2	4		1	3		1	+	3	5	5	4	5	2		
Struthiola ciliata								1			1	2					1	2	5	4			2			
Agathelpis dubia									4		1	4		1	2		2	1	2		5		2			
Ischyrolepis virgea										2	1	4			2	2	1				5		5			
Ficinia cedarbergensis											1	4			2	1		+	3	5			2			
Hypodiscus laevigatus											+	2			2				2		5	4	4	2		
Poaceae spp.											1		5	1			1						2			
BB. Diagnostic species for Community 24																										
Restio occultus	2																							3		
Elegia asperiflora																								4		
BC. Species common to Communities 20, 22 & 24																										
Tetraria sp. nov. (11230)												2								5		4		5		
BD. Species common to Communities 8 to 24																										
Tetraria ustulata								2	2		2			2	3		1	2	5	5	5			2		
BE. Species common to Communities 5 to 24																										
Cliffortia ruscifolia				1	2	4	5	4	5	4	4	5	5	4	5	4	2	1	4		3			2		
Anthospermum aethiopicum					1	2	5	5	2		4		5	3	4		2	3	5	4	3			4		
Stoebe plumosa				1	1	1	2	2	2	4	4	5	5	5	5	2		2	5	4		5	2	4		
Metalasia densa						1	3	4	2		3	5	5	2	3	1	3	1	5	4	5	4	4	2		
Calopsis viminea						1	4	1	2	2	1	4	2	1	2		4	4	5	4			4			
Restio strobilifer																									5	
Babiana sp.				4	5	5	1	4	4	1			5	1			1	+								
Oxalis spp.				1				4		1			5	4				1								
Pentaschistis spp.			1		1	2				1			2	1		1	3	1		5				2		

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
BF. Diagnostic species for Community 25																										
Restio strobilifer																									5	
Elegia neesii																	1							2	5	
BG. Diagnostic species for Community 26																										
Pentaschistis densifolia										2																5
Laurentia arabidea					1																					4
Drosera sp.											+															4
BH. Species common to Communities 5 to 26																										
Ischyrolepis curviramis					1		2			5		3					2	2		5		5		4	5	5
Epischoenus dregeanus											+	4		1		1	2			2		2	2	2	3	
BI. Non-diagnostic species																										
Rhus dissecta				3		2	2	2						1				1	3							
Trachyandra sp.					3					2	+			1			2	1			3		2			
Thesium carinatum						2			4	2	1	4		1	3		1									
Aspalathus spp.								1			+			2			3	+								
Geophyte spp.									2		+			2			1	+			5					2
Cannomois virgata	4	2									1						1					2				
Apiaceae spp.									5			4	2					+								
Crassula spp.					1				2		+	2	1					1								
Paranomus bracteolaris						1	2		2		1		1					+								
Monocotyledonae spp.									4		+		2													
Crassula muscosa				1		2			2									+								
Oxalis obtusa											1						3									
Aspalathus ciliaris								2					4													
Haemanthus sp.			1	1														1								
Pelargonium spp.					1				2				2				1	+								
Salvia africana-caerulea				1					2				2	1												
Acrosanthes humifusa																				2			2			
Albuca sp.					1	1					+			1												
Arctotis laevis				1				1						1												
Caesia contorta																		+		2				2		
Crassula umbella			1	1							+						1									
Erica articularis							2											+	2							
Erica senilis																	1	+				2	2			
Erica sp.																1	1	+				2				
Helichrysum spp.										2							1									2
Leucadendron concavum																		1					4			
Leucadendron loranthifolium								1										+		2						
Mesembryanthemaceae spp.							2			2	+					1										
Oftia africana			1			1		1																		
Othonna amplexifolia			1	1							+							+								
Pellaea pteroides			1	1	1									1												
Pentaschistis thunbergii											-			1			1					2				
Senecio sp.											+					1	1									2
Cuscuta nitida								1			+									2						
Cyperaceae sp.			1							2																2
Eremia totta													2	1	2											
Helichrysum asperum				1		1					+															
Heliophila scoparia								1						1							3					
Hypodiscus argenteus											+										5					
Rafnia amplexicaulis														1			1									
Sutera hispida			1								+		2													
Syncarpha variegata																					3					
Thamnochortus acuminatus																		+								
Ursinia anthemoides					1													1								
Ursinia sp.											+						1	+								
Zygophyllum flexuosum								1										1								
Aspalathus aristata											+							+								
Brachycarpaea juncea														1			1									
Euphorbia tuberosa								1										+								
Euryops othonnoides									2		+															
Campanulaceae sp. (11471)							2													2						
Cissampelos capensis				1														+								
Crassula pustulata						1																				
Felicia ferulacea											+			1												
Helichrysum acrophilum											+												2			

APPENDIX 1.—Synoptic phytosociological table for plant communities in the northern Cederberg (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
BI. Non-diagnostic species continued																										
Helichrysum sp. (11812)																		+								
Hermannia alnifolia				1																						
Hermannia aspera							2							1												
Hermannia scabra								1									1									
Ifloga ambigua																		+								
Indigofera spp.								1						1												
Lachnaea filamentosa												2											2			
Lachenalia sp.														1												
Mohria caffrorum				1									2													
Orchidaceae spp.											+							+								
Passerina vulgaris														1				+								
Pentaschistis colorata																		+								
Prismatocarpus sp. (10859)																										
Protea magnifica												2				1										
Protea repens												2											2			
Stoebe sp.								1										+								
Sutera sp.				1							+															
Tetraria bolusii											+						1									
Thesium oresigenum											+					1										
Tritoniopsis sp.							2												2							

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111 888888 123567	111 889 891	11 24549 04500	1111 11716893568 901237025904	1111111 3457777 8173456	56677789 38915936	4 4568	11 8888889999944 4567890134524	233 612	1 554 028	11111111111111 33334440001111123577 3789017137123695727 8	5566 7823	111 233 912	111 22222334445445 24578945369456 4	1111 0066 2448	1111 44666 57269	11111111111 34001111222 02890457801	111111111 11116777889233334577 23	66 7845	1 775 243	11 22 78	1 990 785	556 190	11 767 359	11 67 70	111 556 083	111111111 12235670023455 37136610064091510
Date Y y m m d d	888888 888888 000000 444444 111111 000111	888 888 000 444 111 222	88888 66678 00110 48204 01021 50982	888888888888 666666777348 000001001000 113332130874 111212002111 885563850271	88888888 7787777 1100111 1013001 2202220 2969895	88888888 67777777 10000000 11111113 10000000 13347899	8888 6666 0001 1111 1110 5668	888888888888 777777777777 000000000011 111333333311 2220000000000 1114444555955	888 666 000 555 122 922	888 667 111 111 112 002	88888888888888888888 66666667777777777777 00000000000011111 56666683344448800211 21122211122220012222 26633302022445632389	8888 6666 1111 2222 1111 0011	888 777 111 000 111 455	88888888888888 66666666666778 00000000011110 45555556812111 11122222210000 76900033429966	8888 7755 0000 3355 1111 2268	88888 67555 01000 81555 12111 11678	888888888888 66777777777777 00000000000000 56444444888888 22222220000000 14334555567777	88888888888888888888 66666666777877777777855 00000001000000111111011 11444442111113000001100 11000002000001122220001 44233553788990300025685	8888 6666 0011 1122 1111 7722	888 777 001 112 002 443	88 77 11 00 11 44	888 777 000 333 111 002	888 666 111 122 111 001	188 757 001 151 012 479	88 55 00 55 11 78	878 735 100 165 201 246	88888888888888888 66666667777777857 00001100001111001 14456221330012111 10010110111122022 44569013023523629
Altitude (in m)	433555 596531 000000	766 674 000	69875 43493 00000	1 7799678990971 0002095660057 0000000000000	1 9099997 7068080 5500000	99998799 75346829 00000000	8887 7398 0000	1 6558889888067 8670494767083 0000000000000	999 522 050	111 226 949 050	11111111111111 11 01133201133431399946 51222326549087798722 00500000000000000000	1111 3233 2665 5005	999 887 005	11111 1111 111 01121911007811 40206805460764 00000000000000	1111 2122 0456 0000	11111 56666 88020 00000	1111111111111 30334541144400 53773113824260 00000055000000	1 9099977787788199997099 00668009599780375750077 00050000000000055000000	9989 8170 0000	999 467 000	99 56 00	111 001 000	223 462 000	955 337 000	65 05 00	777 000 000	1 111 13 1 111 0669034911996901 5045721300116974 0500000000500000
Aspect	000000	SWW W	SNESW WWNS EE	00SWS ENW0E0S S S S S E E W W	0NENNNN WNE WE E	NNW WWNN EW W	0NE0 N E	WSSSWSEWEESEN W SSS NWNN EEW E EE	WWS S W	NEN N E	0WS00ESNNW0ES0SN00NS S SE ES SW SW W E W E E	0S00 S W	SWS SSW WW	SSSSSWSWSSSSESE SWSESSSSEWSNSN W W WWWW EEEE	ENEE N W	NNEN0 E E	SSWS0S00WSSSS W NWSWE W W	WNNNEW W00NNENNNN0 N000 N NN N SE N E EW W E E	NEEN E	NN0 S	SS S E	S00	N00 E	NSN	NS W	W00	NSSWN0NW00SS0NSE0 EWWSE WN SW E W W W
Slope (in degrees)	000000	311	12 4 55501	3 1 3 005224570500	1 1 0545514	I 24504370	0120	11121111 1 6764778714170	566	301	2 3211 12 1 4 0810050041030017005O	0600	211 999	2322211213132222 6327269115598647	2 23 2850	3221 50050	1 6409060036932	1 6143330300235313200400O	1 7825	1 540	1 44	100	100	11 405	21	200	3 2 2 02083022003302350
Geological code	CCCCCC 111111 QQQQQQ 111111	CCC 111 QQQ 111	CCCCC 11111 QQQQQ 11121	CCCCCCCCCCCC 1111111111111 QQQQQQQQQQQQ 1111111122212	CCCCCCCC 1111111 QQQQQQQQ 2212221	CCCCCCCC 11111111 QQQQQQQQ 11111111	CCCC 1111 QQQQ 1111	CCCCCCCCCCCCCC 1111111111111 SSSSSSSSSQSSS 2222222222222 GGGGGGGGG GGG	CCC 111 QQQ 111	CCC 111	CCCCCCCCCCCCCCCCCCCC 11111111111111111111 QQQQQQQQQQQQQQQQQQQQ 11111111111111122222	CCCC 1111 QQQQ 1111	CCC 111 QQQ 222	CCCCCCCCCCCCCCC 11111111111111 QQQQQQQQQQQQQQ 11111111111111	CCCC 1111 QQQQ 1111	CCC 11111 QQQQ 11111	CCCCCCCCCCCCCC 11111111111111 SQSSSSSQSSSSQ 21222221222211 G	CCCCCCCCCCCCCCCCCCCCCC 11111111111111111111111 QQQQQQQQQQQQQQQQQQQQQ 11111111111122222211 G	CCCC 1111 QQQQ 1111	CCC 111 QQQ 112	CC 11 QQ 22	CCC 111 QQQ 111	CCC 111 QQQ 111	CCC 111 QQQ 112	CC 11 QQ 11	CCC 111 QQQ 111	CCCCCCCCCCCCCCCCCC 1111111111111111 QQQQQQQQQQQQQQQQQQ 1111111111Q212112
Substrate type	SSOSSS OOIOOO IIRI R	SSS OOQ BII	AOSOS SSRII B BB	SSSSSLSRS SS GO I O RG B G	SSSSSSA GGGOOGG IIR GRR	SASSSSSS GGGGGGGG RIIRIRII	SSSS GGGG IIII	AASAAAACAACAA GS CCCSACCAGG IG GGGIIIIGII	SSS GGG III	SSS GGG RRR	SSSSSSSSSSSSSSASSSSS IOOGGBGIBIGGGISGGOIA GIIIBRIBR BOBBIIIRBI	SSSS GGGIG BRB	SSL IGI BIG	SSSSSSSSSSSSSSS GOGOOGIGGGGGOOI IGIGGIRIIIIIBIB	ASSS GGSSS GIIG IGBIR BBBB BI B	SAAASASSSSLSS GSSSGG GGGOGG IG III I IGII	SSSSSSSSSSAASSSSSSSSS GG GA GGSS GGGGG I	SGSS AAS RGG SSG II GGR	SS GG II	SSS GGG BB	SSS OGG OG	CSS AOO R	S G RR	SSS GGO	SSASASSASSSSSSSS OGSOSG SG GGOOIIB I GG II RI GB
Soil depth (in cm)	1 5 552105	55 410	63 24 00005	5664544 5 2 0000000000 0	1 555 055	15888459	2111 5055	155522121431 9411166590008	122 713	11 005	2332342311332231131 1 5575205059990080099	2111 0007	453 005	1223224331222331 00025260005000	11 005	11 05	1352113522532 9 4710494100105	1111 1 1 0005561645554450535525555 0000000505555110501001	1 5685	111 045	1 07	220 661	921 005	5 4 559	41 005	1 466213211015512 0005855401700505
Grid reference	333333 222222 111111 888888 BBBBBB BBBBBB 000000 666666	333 222 111 988 ABB BAAB 000 466	33333 22222 11111 89998 BAAAB BAAAB 00000 97749	3333333333333 2222222222222 1111111111111 8899888999998 BBAABBBAAAAB ABAAABA BBAABBBAAAAB 0000000000000 6644666444446	3333333 2222222 1111111 9899989 ABBABBBA ABAAABA 0000000 4684464	33333333 22222222 11111111 98898889 BBBBBBBA BBAABBBA 00000000 46646667	3333 2222 1111 8889 BBBB BBBB 0000 6666	333333333333 2222222222222 1111111111111 88899999999999 BBBAAAAAAAAAAA BBBAAAAAAAAAA 0000000000000 6664444444744	333 222 111 999 AAA CCC 000 999	333 222 111 999 AAA AAA 000 777	33333333333333333333 22222222222222222222 11111111111111111111 99999999999999999999 AAAAAAAAAAAAAAAAAAAA CCCCCCCCCABAAAA CCCCCCCCCAAACCCCCCAAACC 0000000000000000 99999977795559644499	3333 2222 1111 9999 AAAA AAAA 0000 7777	333 222 111 999 AAA AAA 000 444	33333333333333333333 22222222222222222222 11111111111111111111 99999999998999999 AAAAAAAAAAAAAAAA AAAAAABBBBBBBBAAAAAAAAAA 0000000000000000000000 5556699698977777	3333 2222 1111 9999 AAAA AAAA 0000 7777	33333 22222 11111 99999 AAAAA CAACA 00000 27727	333333333333 2222222222222 1111111111111 9999999999999 AAAAAAAAAAAAAA CCCCCCCCCCCCCC 0000000000000 9999556966566	333333333333333333333333 2222222222222222222222 1111111111111111111111 99999988888888999999999 AAAAAAAAAAAAAAAAAAAAAA AAAAAAAAAAAAAAAAAAAAAA 0000000000000000000000 4444499666666844444844	3333 2222 1111 9999 AAAA AAAA 0000 7777	333 222 111 999 AAA AAA 000 444	33 22 11 99 AA AA 00 44	333 222 111 999 AAA AAA 000 887	333 222 111 999 AAA AAA ACC 777	33 22 11 99 AA CA 00 429	333 222 111 999 AAA AAA 000 27	333333333333333 2222222222222 1111011111111111 98899998999999999 ABBCCAABAAAAAAAAC 0000000000000000 7995677677447488 9
Percentage cover of rock	19 1 105010	8 555	13999 00955	1 231 9976 9 5005055905O5	9999568 7990005	89919699 00050058	192 5055	1221 5505555000111	2 555 005	459 005	1545 2199522869992 50558058900550058500	948 0505	999 580	842642882923962 505505055000050	9969 5800	9668 05000	975 2 5000000015021	72 6 0000000000000000005000	0020	99 001	88	010	011	000	5 00	6 1 1 9282 0001501030880550O
Percentage cover of litter	211 1 950590	111 000	151 2 05080	438899121 2 000025505 0	31 863505	21111321 05550050	1123 0000	45222 126 221 5050080001055	286 555	212 000	2123234111111 11 3 5500005005500550	1 52 0500	1 087	11 1 3121111 3 2 00503000000550	561	1 52 1 55 5	41112 1112 1 0000555000507	1212225 33682222 11 22 0550000055550505050882505	41 0088	2 320	1 60	111 005	11 008	55	11 00	23121 11111282 500555500050505
Percentage cover of vegetation	111111 000000 000000	11 900 700	1 08998 00900	1 1 999990990799 995500850050	6815652 5065052	75466644 01900555	8467 0958	8789999989799 5005555509358	797 058	656 005	7666858676885775487 6 6500550007055005550O5	9599 5100	999 505	977689466799478 000500505080905	8668 0055	74588 88005	7989998899999 0650085585953	5699987899779978899965 5056156053074005567855	7899 0000	998 520	87 08	1 999 550	099 057	099 084	99 08	879 005	1 78079599997886994 85000546887550055
Vegetation age code	MMMYMM M	MYM M	MSMMM	MMMMMMMMMMMM M	MMMMMMM	MMMMMSMS MM	MMSS	MSMMMYMMSYMSM S M SM M	MSS	MMM	SMMMMMMMMYMMYSMYMSMM S S SM M	MMMM	YYY MMM	MYYYYSYMYYSYYYS MMMM M MM M M	MMYM	MMMMM	YMYMMMMMMMYMY M M M M M M MMM M	MSYMYYSYMSSSSMYYYMMMYYS M M M M MMM M	MMMM	YYM MM	YY MM	MMM	MMM	YMM M	MM	MMM	SMMMMYMMMMYYMSYYM S M SMM M
Wetness code	WWWWWW	WWW	DDWDW	DDDDDDDDDDDDD	DDDDDDD	DDDDDDDD	DDDD	DDDDDDDDDDDDDD	DDD	DDD	DDDDDDDDDDDDDMDDDDDDDD	DDDD	DDD	DDDDDDDDDDDDDDDD	DDDD	DDDDD	DDDDDDDDDDDDDDD	DDDDDDDDDDDDDDDDDDDDDDDDD	DDDD	TTD	DD	DDT	DDD	MTT	TD	DDT	DDDDDDDMDTTDDTDDTD
Rainfall (in hundred mm)	443444	766	69756	445534654565	5565554	88876568	6564	4444555555844	776	1 884	1 777997799900070555O4	8888	555	88877788677998	9811	24222	9600110770108	558876646556685545547555	6655	785	55	888	888	812	22	444	1 1 556878888855457911
Number of species	111111 343335	111 423	22132 47400	2222223122222 5127402630111	3312323 3071481	22222222 79374896	2322 8316	2333313333244 3160251413830	222 987	121 907	2332223213112223322322 3 9335333287763233321O	2212 7090	554 168	3223234343344442 7792994656460491	1111 9849	1 17889	2223112232213 4644232157770	3133322321212222332333 1 1953572355169483524371 7	2233 7427	332 007	33 26	111 326	11 916	111 930	55	1 235	13 222111133 121 9295131646871360 7

A. Diagnostic species for Community 1																											
Brabejum stellatifolium	33234																										1
Prionium serratum	42 12																										
Platycaulos compressus	+ 221																										
Freylinia lanceolata	123																										
Phragmites australis	1++																										
Imperata cylindrica	21																										
Cliffortia strobilifera	1 1																										
Rhus angustifolia	+1																										
Juncus lomatophyllus	+ +																										
Psoralea oreopola	O 1																										
B. Species common to Communities 1 & 2																											
Pteridium aquilinum	222 1	1+												O													1
Elegia capensis	1	O32										2															
Berzelia lanuginosa	1	+																									+
Psoralea pinnata		O+																									
C. Species common to Communities 2 & 3																											
Todea barbara		2 2	1++																								
Halleria lucida		O +	2+ +																								
Blechnum sp. (188.7)		1+	+																								
D. Species common to Communities 1, 2 & 3																											
Metrosideros angustifolia	43443	555	23413																								4
Brachylaena neriifolia	O1120	1+	1 2 +																								
Calopsis paniculata	1111 1	11	+ +																								
Erica caffra	1 11	+	1 +																								2
Myrica serrata	1	+1	3 2																								
Buddleja salviifolia	2		1																								2
E. Diagnostic species for Community 4																											
Euclea acutifolia				11O+ + +++				O+						1													1
Melianthus major				+1 +11 +				+						1													
Rhus tomentosa	1	O		+1 + +++																							2
Euclea lancea				1 221																							
Anisodontea bryoniifolia				++1		+																					
Viscum pauciflorum				+ + +																							
Stachys aethiopica				1+																							
Knowltonia vesicatoria				++										R													+
Ehrharta sp.				+ +																							

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111 888888 123567	111 889 891	11 24549 04500	1111 11116893568 901237025904	1111111 3457777 8173456	56677789 38915936	4568	8888889999944 4567890134524	233 612	1 554 028	11111111111111 33334440001111123577 3789017137123695727 8	5566 7823	111 233 912	222222334445445 2457894536945 64	1111 0066 2448	1111 44666 57269	11111111111 34001111122222 02890457801 23	111111111 1111167778892333345 77 1245689667812963469 3612	66 7845	1 775 243	11 22 78	1 990 785	556 190	11 767 359	11 67 70	111 556 083	111111111 12235670023455 68 37136610064091 510
F. Species common to Communities 3 & 4																											2
Olea europaea subsp. *africana*			21+11	2232333322+1				o			1+ o		+	1 o													
Chironia baccifera			+ o	+11+1+++1+1+																							
Hartogiella schinoides			12+21	1211 1 32++	o																						
Secamone alpini		o	11 1+	122 1 12++																							1
Euclea natalensis			1	+2+1221 +																							
Diospyros austro-africana			+	1111 212																							
Protasparagus retrofractus			+	+++10 1 1																							
Kiggelaria africana			1	3+ 4								+															
Senecio vestitus			11+	1+ 1										R													
Myrsiphyllum kraussianum			+ o	o+	+																						
Colpoon compressum			2	2+										o													
Lidbeckia lobata			+	+ +																							
Protasparagus aethiopicus			+ +	+																							
Solanum tomentosum			+																								
Zantedeschia aethiopica			+	+																							
Crassula decumbens			+	+																							
Hemimeris montana			o	+																							
G. Species common to Communities 1, 2, 3 & 4																											3
Clutia pulchella	0011	++1	2 +	1 2 + +		o		+						1				+									
Rhus undulata	1	1	1+ +	111+2321 ++1																							
Podocarpus elongatus	1	1 1	23 12	2 4 1																							
Cassine peragua		+	o 1	3223 121										1				+									2
Indigofera frutescens		+	o+	+1+																							
H. Diagnostic species for Community 5																											+
Aloe mitriformis				o	1 ++1																						
Ruschia decurrens					+00 + +		o																				
Conophytum minusculum					+o+																						
Crassula rupestris					+ +																						
Albuca cooperi					++																						
Ornithogalum cf. *conicum*					+ +																						
I. Diagnostic species for Community 6																											
Lampranthus cedarbergensis						+ +o1+o												+				o					
Ruschia solida						1+1+																					
Cannomois taylorii					o	1																					
J. Species common to Communities 5 & 6																											
Crassula atropurpurea					++1 +++	++o+ ++1				o	+	o		o													
Ruschia dasyphylla					+2 1+1	oo+ o1																					
Protea glabra					oo 1++	o1o1 2																					
Pelargonium alternans					+++++	+++ 1																					+
Adromischus maculatus					+o+ ++	++				o																	
Euphorbia loricata					1 1 +1	+ +																					
Aspalathus polycephala					+	+ ++ 1+				o																	
K. Species common to Communities 3, 4, 5 & 6		1																									
Heeria argentea			31+32	1 23 113334	oo2o 1	oo11+ +o						+o			+												
Protasparagus suaveolens			+	+ +++	1+++++	o+ oo	+						1														
Rhus rimosa			o	1 11 + 2	1	oo101+++								1 o													
Clutia polifolia			+	+11++	o	+									o												
Crassula atropurpurea var. *watermeyeri*			+	1		R																					
L. Diagnostic species for Community 7																											
Macrostylis squarrosa						2 o1												2									
Aspalathus hirta						++																					
Erica verecunda						1 +																					
M. Species common to Communities 5, 6 & 7																											
Restio perplexus					2 2+ 1	2o+122 1	+12+																				
Crassula dejecta			+		oo ++++	o10 +	+							+													
O. Diagnostic species for Community 8																											
Elytropappus rhinocerotis								3202253+41321										o ++									
Ehrharta bulbosa/capensis								+ 22 +1+++++																			
Athanasia trifurcata								1 ++++++ +o																			o
Protasparagus rubicundus				1+				o + +oo o+										1									
Elytropappus cf. *gnaphaloides*								2 2+ 1 1																			+
Nylandtia spinosa					+			110 +2					+														
Arctopus echinatus							+	1+ +o+																			
Printzia polifolia								+1 ++o																			
Senecio rosmarinifolius								+ o +10																			
Erepsia saturata								o + + +																			
Salvia albicaulis								1 +1										11									
Aspalathus lanata								o + +																			
Ficinia brevifolia								+ +																			
Crassula sp. (84.7)								++ o																			
Wiborgia tetraptera								2 o																			
Ornithogalum thyrsoides								++																			
P. Species common to Communities 5, 6, 7 & 8																											4
Cheilanthes contracta				+	+ 1+ +	++o+ +	+							+													
Merxmuellera arundinacea					+	2	o+3	1 o 10																			
Thunbergiella filiformis								+																			
N. Species common to Communities 1, 3, 4, 5, 6, 7 & 8																											2
Phylica oleifolia	1	1	210+1+2 o 11	1 o2	1++11 20	++R2	+ o 1				+ o			o	+			o		+	R						3
Dodonaea angustifolia	1 1o	+	2	2 +1			00100 o + 21														R						
Q. Species common to Communities 5, 6, 7, 8 & 9																											
Anthospermum galioides					++ + ++ ++++			+++ + R			+						+ o			+							1
Euryops speciosissimus					1 ++			1 + 1+1				+															1
Phylica rigidifolia						1	1o	22			o		+														
R. Diagnostic species for Community 10																											
Dolichothrix ericoides										++																	
Mesembryanthemaceae sp. (11672)										+o+																	
Othonna retrofracta										+o																	
S. Diagnostic species for Community 11																											
Widdringtonia cedarbergensis										1	220 2 000+2120																
Stoebe aethiopica						+					o 0010 + ++ +		1					o			+			2			3
Ischyrolepis ocreata											342 4																
Restio patens											11 1 1					1											
Erica parilis											2 1 + o																
Pentameris dregeana											++ 1 1				+1												
Stoebe saxatilis											+ + +1							o									
Cliffortia triloba											+ ++																
Simocheilus glaber											2 1																
Erica calycina											+ 1				+												
Paranomus tomentosus											o +																

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111 888888 123567	111 889 891	11 24549 04500	1111 11116893568 901237025904	1111111 3457777 8173456	56677789 38915936	4568	11 8888889999944 4567890134524	233 612	1 554 028	11111111111111 33334440001111123577 3789017137123695727 8	5566 7823	111 233 912	111 22222233444544 24578945369456 4	1111 0066 2448	1111 44666 57269	11111111111 34001111122 02890457801 23	111111111 1111167778892333345 12456896678129634693612	66 7845	1 775 243	11 22 78	1 990 785	556 190	11 767 359	11 67 70	111 556 083	111111111 12235670023455 37136610064091
T. Species common to Communities 5, 6, 7, 8, 9, 10, 11 & 12																											
Passerina glomerata					+OO+1+2	1+ 2+2++	1+2+2+++1 1 211		1	221 4 + 1		1++															
Eriocephalus africanus					+O1 1++	12 1 1	1 2	121 ++ +3 ++	2OO	++ +1+O++ +1O 2		+		+			+	+		2						2	2
Diosma acmaeophylla				1	211 2 +	22 2 O12			O2	+2 1 O 1		O								1						1	O 1
Oedera sedifolia					11 +1+	1			1O	112 + 1		O								+						3	
Lampranthus lunulatus						+1+++1+1				11		OO														1	
Felicia filifolia					O	O	+ 1				+ ++2 O																
Phylica fruticosa					+ 1	+					1O+ O 1 2 1															+ + O	
Indigofera filifolia					1 +						++ O+			O													
Senecio crassulifolius					++					++																	
Helichrysum scabrum					+ +						1														+		
U. Diagnostic species for Community 13																											
Cliffortia hexandra													121														
Erica placentiflora													+1+														
Crassula sebaeoides													+++								++						
Silene undulata											+		+++	+													
Thesium sp. nov. (11819)													++O	+													
Microloma tenuifolium													++O	+													
Tephrosia capensis													11														
Selago spp.													+++														
Erepsia sp. (11828)													+++														
Sebaea sp.													++														+
Microdon bracteatus													OO														+
V. Diagnostic species for Community 14																											
Cheilanthes induta			+	1							+			+1+1+ ++ +													
Manulea cephalotes														1+ + +													
Psoralea oligophylla											+			21O O													
Pteridophyta spp.								+						+O+ +													
Senecio pubigerus														O+ + O										+			
Osteospermum connatum														O O O													
Senecio cf. *pinnatifidus* (34.32)											OO			O1+													
Rhus rosmarinifolia														OO													
W. Species common to Communities 13 & 14																											
Protasparagus compactus											O		1++	O1O1+++++ OO+													O
Othonna parviflora											O		R	1 + O O+ +													+
Galium capense											+		1	1+ ++ +													
Pelargonium tabulare													+	O +													
Felicia diffusa													1	+													
X. Species common to Communities 11, 13 & 14																											
Selago serrata											O + O		++	+ OO													
Cullumia bisulca							2				+ 2 1			+ O 1+													
Hermannia sisymbriifolia											1 + O +			+ + 1							+						
Pelargonium englerianum							+		+		+ ++	O		+ 1													
Senecio paniculatus											+ O +			+ O													
Senecio tuberosus											+		+ O	+ O				+									
Senecio burchellii											+O			O													
Crassula pubescens											+			+													
Y. Species common to Communities 8, 9, 10, 11, 13 & 14																											
Protea nitida								O 121 +O2	O		OO2		243	22O222202102222				O								2	2
Osteospermum rigidum								+ +			+ +		+ +	1 +++ + + O+			+										
Montinia caryophyllacea							1	O122 +					+2	2 12													
Centella lasiophylla								+ +			1			+ +1++ +													+
Crassula fascicularis								O O			+			+ ++ 1 O							+					+	
Pentaschistis malouinensis								+ +O +					1	++ +													
Tribolium uniolae								+ + + O						+ O +										+			
Selago scabrida								O+						+ + +													
Watsonia marginata					+			++						++													
Helipterum virgatum								+						+													
Z. Species common to Communities 8, 9, 11, 13, 14 & 15																											
Ischyrolepis gaudichaudiana				+				+ 1 1 2 2			O24 2122 O		555	33235413230424 4 +O12												2	5
AA. Species common to Communities 5 to 15																											
Ficinia nigrescens				+	+++1+++	1121++1+	+1 +	+ ++++	112	++ 11 + ++1+++2+++ ++		O	111	+221221122 +111 +		1 +		+ +									+ + 1 ++
Pentaschistis eriostoma					12 +1+	++	2	1 O 1	1	+1 ++O+O O O		O2+		+ 112O+ 2+ 1+ ++		1 +							+			O + +
Phylica ambigua						+	O+1			1 O 111				+ 1 2		1											
Campanulaceae spp.									OO	++			OR+					++									
Ursinia sericea						1	O			+ 2 +				2 2		+ +								R			
AB. Species common to Communities 4 to 15																											
Lobostemon glaucophyllus				01 2			+1+	O O		+			+	121+2++O1 +O				O +								+	
Rhus scytophylla			O	+ 1++	O ++	+ O				+ +O O O+				O+ O O O													
AC. Species common to Communities 1 to 15																											
Peucedanum sonderi				1 + O									1														
Maytenus oleoides		1	1113	+1211+2122+2	O 1	+OO		O		++ O			OO	O OO 1 OO+ O O												1 O +	
Diospyros glabra	1 1	+ 1	21+1+	1+ +1+1+12		O		O O		+ O 1			+	1 + OOO O O O ++													+
Myrsine africana	+		1	1121++1+2+2	+					+ O			O +	+O+													
Ficinia acuminata			+	+1O+ +		O+				+			++O	1+1 O 2O O													
AD. Diagnostic species for Community 16																											
Tetraria triangularis																OO++											
Agathosma stilbeoides																+ 2											
AE. Species common to Communities 11 to 16																											
Ehrharta ramosa			1 O	O	O		+				2+ 121 1	+	O 2 1 1 2121	1+2 O2+1	+											+ O	1
AF. Diagnostic species for Community 17																											
Leucadendron glaberrimum																	1 11 104 2 +									+	
Athanasia microphylla																	O21 ++++++										
Aspalathus triquetra														+			O 50 + 4		1				+				
Protea acuminata											1						3 3 2 3										
Ruschia lineolata								+									O + + +										
Andropogon appendiculatus																	1 1							1			
Muraltia alopecuroides																	1 +										
Athanasia bremeri																	+ O									1	
Indigofera sp. (11909)																	+ +										
Cliffortia baccans								+									+ 1										

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111	111	11	1111	1111111			11		1	1111111111111		111	111	1111	1111	11111111111	111111111		1	11	1		11	11	111	111111111
	888888	889	24549	11116893568	3457777	56677789	4	8888889999944	233	554	333344400011111123577	5566	233	22222233444544 5	0066	44666	3400111112222	11116777889233334577	66	775	22	990	556	767	67	556	1223567002345568
	123567	891	04500	901237025904	8173456	38915936	4568	4567890134524	612	028	3789017137123695727 8	7823	912	24578945369456 4	2448	57269	0289045780123	12456896678129634693612	7845	243	78	785	190	359	70	083	3713661006409151 0
AG. Species common to Communities 11, 13, 14 & 17																											
Clutia alaternoides											+1+ O + 1		11+	2111+1+++++111+	1 +		O1 1+										+ O +
Elytropappus adpressus									1+		O +1 O			O 1 3++1			21+31+2132311										32
Pelargonium laevigatum											+ +++2 + 1			+1+++ 22+			O +										
Scabiosa columbaria											+ ++ +		O1	O + O +			O+	1									
Othonna auriculifolia									O		+ O + +O+			+			++ +										
Pentameris macrocalycina											+ +	1	+2	+			1 +										
Castalis nudicaulis											+ +		++O	+ +			. +										
Phylica leipoldtii											2 12						1 +										
Selago glomerata											1O	1+					1										
Aspalathus galeata											1						O +										
Agathosma divaricata											+						+										
AH. Species common to Communities 8, 9, 11, 13, 14 & 17																											
Oedera squarrosa								+ O+ O+	1+1		1+			1 R			+										+ 1
Helichrysum dasyanthum							1	1 2111 O2			+ +		+	1			+ +										
Agathosma capensis								++ 1+1+ +1						1 + +			+ 1										. O
Festuca scabra								OO + O + +					+++	+			++										
AI. Diagnostic species for Community 18																											
Thamnochortus platypteris											+						1	231+ 11 4+ 4232112312 22					+				21 ++
Aristea dichotoma							+											++ + ++ +++ + 1+									O +
Tetraria compar																		O11 11O 1O 1+ +									1
Ischyrolepis monanthos																		32 21 + 2 3 5 33									+
Ficinia bulbosa																	+	+ + + + + O+ +++									
Metalasia fastigiata							+											1+O 1 3 1 11 21		+							
Rafnia diffusa																	+	1 3 2 + + 2 14 2									++
Protea acaulos																		O+O O O O									O1
Leucadendron salignum								1 1										O O OO O									
Athanasia flexuosa																		1 1O3++									
Osteospermum acutifolium													1 +					2+ ++ +									
Willdenowia incurvata								4 2+										33 21+									
Thesium hispidulum								+									+	+ + O +			+						+
Stoebe leucocephala																	2	2+ +									+
Psammotropha anguina																		1+ +									
Eriospermum lanuginosum																		+++									
Ficinia indica								+		+								+1 +									+
Pharnaceum incanum								+										+ +O									
Lachnospermum fasciculatum																		2 2									
Lobelia coronopifolia																		++									+
Syncarpha canescens																		+ +									+
Dischisma ciliatum																		O +									
Serruria aitonii																		+ O									
Gosela eckloniana																		O +									
Stipagrostis zeyheri																		O +									
Pentaschistis aristidoides																		+ +									
Anthospermum bergianum																		+ O									
Ursinia pilifera																		R + +									
Helichrysum moeserianum					+													+ + +									
Moraea spp.																		+ +									
Aspalathus vulnerans							+											1 1									
Adenogramma glomerata													O					++									
Grisebachia ciliaris																		O +									
AJ. Species common to Communities 17 & 18																											
Muraltia rhamnoides																	O + 1 O2	1 ++									1
Arctotis diffusa														+			+ 1	O R ++ +									
Lobostemon echioides																	O+	1 1									O
Gymnodiscus capillaris																	O +	R+ ++ 1									
Selago spuria																	1	1 1									
Manulea laxa																	+	1									+
AK. Species common to Communities 9 to 18																											
Ischyrolepis unispicata									O+		1			++			153125 3 +444	1 12 + 1			+						O2O + +
Gnidia geminiflora									+O+					+ + ++			++ O +++121+	111 + +									1
Pentaschistis viscidula											+			22011+++				O+121 ++ + O									+
Cymbopogon marginatus														1 1 + O			+	1110 1++		+							2
Senecio erosus													+	+			+	++									
Senecio arenarius													++	+				+									
AL. Species common to Communities 8, 11, 13, 14, 17 & 18																											
Merxmuellera stricta								1 1++	1		++ + 1		+2	1111 1++1	+		++ +102	+ 1+1++ 1									++
Lasiqchloa longifolia							O	++ O1++++ ++	O		+		+	++++ ++O			+ + ++	++O O									+ +
Lampranthus laetus							+	++			1 + ++ ++			1 ++1			+	+ + ++ O OO+ ++									+ +
Ficinia dunensis								1+			+						++ +	+ + 1 +1+									O+1 +
Cliffortia polygonifolia								2O 1							+			1									
AM. Species common to Communities 5 to 18																											
Thesium subnudum						+	1+ + +	O + + ++			++	1						1 + 1 1 ++ +++ 1+		O							O
Chrysocoma ciliata		+1					O	+ O O	+O				+	O			+ +	O 1+1 R									+
Gazania serrata						+	+	+			+			+			+ + ++++	+1									
Pteronia camphorata						1	1	++	+ +		O 1	+ ++						1 +									1
Ruschia dichroa						++ 1+++												+ O+ + +									1
Pelargonium scabrum		+				O +		++			O			+++ O				+ +									1
Cyphia digitata						+			+		O		O	+ R O				O									
AN. Diagnostic species for Community 19																											
Elytropappus scaber																			1O++								
AO. Species common to Communities 18 & 19																											
Lightfootia cf. *spicata*								O									+	O 2 11 1 1 +++1 ++	++								+++
Agathosma pubigera														+ 1				1 1	1+11								
Diosma meyeriana					+		+						+				2	13 1	+								+
Aspalathus linearis																		O +	O +								1
AP. Species common to Communities 5 to 19																											
Ehrharta calycina/villosa		+ +			+30222+	123221++	2101	111+ 21++++11	2+1		+ ++ ++	++1	2 221 +12+ 1 +1				1+++++1+1+++	++11++11+1+1+ +++++++	++		+						1 21 1 + ++
Ischyrolepis sieberi					1 11	12 + 1	3 21	+1 11		223	O O+2 45+14 O1 1	212+		+ 521	+3	4 2+4		421+42 2	3212		+				+		34 21
Stoebe intricata					2	110011 1	303	O 1 +			21 1+ + + 1						O	O	++								11 3
Ruschia tardissima						++	++	++			O							1+									O +
AQ. Species common to Communities 19 & 20																											
Hypodiscus neesii								1 O1			3						4		2232 2								+
Selago lamprocarpa						O	1+											+	+++1 OO								O
Lobelia capillifolia											+								++ +								

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111 888888 123567	111 889 891	11 24549 04500	1111 11116893568 901237025904	1111111 3457777 8173456	 56677789 38915936	 4 4568	11 8888889999944 4567890134524	 233 612	1 554 028	1111111111111 33334440001111123577 37890171371236957278	 5566 7823	111 233 912	111 22222334445445 245789453694564	1111 0066 2448	1111 44666 57269	11111111111 3400111112222 0289045780123	111111111 111116777889233334577 12456896678129634693612	 66 7845	1 775 243	11 22 78	1 990 785	 556 190	11 767 359	11 67 70	111 556 083	111111111 1223567002345568 37136610064091510
AR. Species common to Communities 18, 19 & 20																											
Tetraria nigrovaginata							O	+										+11111 1++ +++ + 1 +	1+	++							1 +
Pelargonium coronopifolium											+	O						++ + + ++ ++O+ +++1	+	+			+				+ +
Macrostylis tenuis/decipiens											2			O	+		1	1+ 21 ++1 + O+	+ 11	+ +							O
Rafnia cuneifolia																		+O +	+	+							1+
Haplocarpha parvifolia												+						O+O		+							+ +
AS. Species common to Communities 13, 14, 17, 18, 19 & 20																											
Willdenowia arescens											O		++	1 2 +			2 1 3 2	222020 2 2 14 21204+11	1 2	13							+ 22 1001
AT. Species common to Communities 6 to 20																											
Helichrysum cylindriflorum						+	+ +	+ + ++	++		+		++	+++++++++O1 ++			+ + ++	+ + ++	O	O							+
Aspalathus divaricata							+O+	1 +										1 11 1 +		1+							
Protea laurifolia						1 1 O		O+1 20	253		2 +1							O 3	O	+OO							1 O
AU. Diagnostic species for Community 21																											
Centella cf. *recticarpa* (11811)																		+			11						1
Lachnaea globulifera																					++						+
Bobartia rufa																					++						
Aspalathus sericea																					++						
AV. Species common to Communities 18, 19, 20 & 21																											
Elytropappus glandulosus								2					+	+			O	1 1+1 1 +1 2+		O +	11	+					+ ++
Thesium nudicaule																		1+ + + ++	++		++						+ ++
Simocheilus puberulus											1							O +	1		1						1
AW. Species common to Communities 8 to 21																											
Tetraria cuspidata								+ + +			++O+11+ 1 + 1+++		1+	++ + ++	1 +		+1++ +1 11	111 O 1 ++	O+21	2++	11						1 1 ++ +
Corymbium africanum								++ +1 ++	+O		+			1+2 1++ 1 1O	+		+ + +	1+2 + +			+1						+O +
Ischyrolepis capensis								+1 1111+++11+	2 1									+1 1 1		+	+						+
Muraltia heisteria							++				1 1 O+ ++	O+	+					+++	+++		+						+
Pentaschistis curvifolia								++O+ 1					+				O	1 O	+O 1	+	+						+1 +
Ursinia punctata								+ +			O O11+	O	111	+1 1	+				1	++	+						+ 1
Tritoniopsis antholyza							O	O + ++						+				+ + O		++	+						++
Lobostemon trichotomus								O			1 +						+O 1 +	O+	+ 1	+	+						+
Ficinia filiformis								+ +			+ +			+1+	+		+				++						+
Phylica villosa								+ OO			+ +							1 O	1 1	+							1
Osteospermum bidens							+				++ +	+		O					+		O+						O O
AX. Diagnostic species for Community 22																											
Staberoha aemula																						132	+	O2			21 2
Willdenowia sulcata															1		1	2				++1					1
Tetraria crinifolia																						O1+					+
AY. Species common to Communities 11 to 22																											
Ficinia petitiana							+				1 + O+	+ +		+	+			+ + + ++	++	+		+					+ +
Prismatocarpus fruticosus											+ O ++ ++	O +		1 ++ + ++	R		O	+ O	+	1	++	+					+
Thesium strictum											O +			O + +O	+			+	R +	+	+						
Dilatris ixioides											O							+	+	O++	+	+					+ + ++
Selago rudolphii																	+	+ ++		O		O					
AZ. Species common to Communities 20 to 23																											
Elegia filacea											1	1O 2					1 1	+ 5		312	43	235	543				12 334
BA. Species common to Communities 9 to 23																											
Cannomois parviflora							+		2+	1+	2 12121 11 2 1222	2112		+1 1++	2+3O	3222	O315 22 3	2 3O1 O+ 13 +1	2123	31+	++	2	+13	1			+ 212 112 1
Ficinia deusta							+	+	+		++ + O O1		+	1 O+1O++++1 O	+ +		+ +++ + ++++	1+112 ++ + ++	1 1	++	++		1				+ +11 + ++
Restio filiformis										+	111 +++ 2	22 1		+	1 +		+	+	1O	+11	+1	+ 1	R11	+			1+ 1O
Struthiola ciliata								+ +			2 O + +	+					1 O	OO1 O O+ 1	+1++	O+			+				1 +
Agathelpis dubia									OO		O +	+O +		O	+		+1 + +	1O1	O		+O		+				+ + +
Ischyrolepis virgea										3	+ 1 23	43 3			+	3 3	3 1				21		R+2				O
Ficinia cedarbergensis											2 1	+O +			+	+		O	+O	+1+			+				+
Hypodiscus laevigatus											O	2			3				+		+1	2 +	21	1			+ 1
Poaceae spp.											++		+++	++			+						+				+
BB. Diagnostic species to Community 24																											
Restio occultus	O1																							2 3			1
Elegia asperiflora																								31			
BC. Species common to Communities 20, 22 & 24																											
Tetraria sp. nov. (11230)												O								13O		2+		232			2 1 +
BD. Species common to Communities 8 to 24																											
Tetraria ustulata								O + O	O		1O +1++ +O			2O 1 1 1	1 1		O	O + 1 +1 +	1+22	11+	++			+			1 1+
BE. Species common to Communities 5 to 24																											
Cliffortia ruscifolia				+	1 1	22 1 ++	211O	O1 +++++ 11	222	1 +	+ + +1++211 ++++++	++1+	+++	1 ++ + +21+1+	O1+1	+ 1+O	1 O +	+ + 3 O	+++		+			1			1 1 ++ O +
Anthospermum aethiopicum					+	O +	+++1	21+12 1+11+1+	+		++ +O++++++++O+ +		1++	+O 1 2+11 ++	++ +		1 1 + +	+ 1 O11OO + O +	+1++	1+	+			+ +			+1 O +
Stoebe plumosa				O +	1	1	1	O OO +	+	+1	OO1122+++1O+1 +1	123+	++1	111++2+++121113	2223	2+		1 O+ + + +	+1O+	O+		RO+	R	+3			3 1 21 + 1
Metalasia densa						1	++	O+2 14 5 12	O		OO3 + 1 11O+	1131	++O	+ ++ + +	++	+	+O2 2+32	O O 1 O	21++	++	12	+O	R+	+			1 OO +2+1
Calopsis viminea						1	+ +1	+	O	+	+ O + +	21 +	+	++ 1	+		+3++ +12+ 31	211 1+11O+ ++ 1+1 1	+221	++			+1				+ 222+ +
Babiana sp.					++ +++	++ +OO++	++++	++	+ O	O+	+ +		+++	+ + +			+ +	+									+ +
Oxalis spp.					+				++		++ +		+++	+++++++++O ++				O +									+ +
Pentaschistis spp.				+		+	R				+ + +		+	1		+	+ + + ++ +	+ 1 + +			+O			+			1
BF. Diagnostic species for Community 25																											
Restio strobilifer																									21		1
Elegia neesii																	O							+	++		
BG. Diagnostic species for Community 26																											
Pentaschistis densifolia										+																+++	
Laurentia arabidea					+																					+ +	
Drosera sp.											O															+ +	+
BH. Species common to Communities 5 to 26																											
Ischyrolepis curviramis					+		2			+22		O1					21+	+ O + 2+ +		+3+		+1+		+3	45	545	+4 51+3
Epischoenus dregeanus											+	++1		+		+	+ ++			O		+	2	+	+		+ 1
BI. Non-diagnostic species																											
Rhus dissecta				+1O 1 +		+O	O	111 ++						1				1O +	O 1								+11
Trachyandra sp.					+ +++					+	+			+ + O			+ ++	+ +			+		+				
Thesium carinatum						1O			+ O	O	O +	+O+		+	++		O +										
Aspalathus spp.								+			O			1+ ++ +			+ ++ +1+	1									
Geophyte spp.									+		+			++ + +			+	O			++					+	+
Cannomois virgata	1 111	1									+ +						1					+					2+
Apiaceae spp.									+++				++	+ R + O				+									
Crassula spp.					+				+		+		+	++ R				+ +									+
Paranomus bracteolaris						O	1		O		3 + O			O				+									
Monocotyledonae spp.									++		+			O++ +													
Crassula muscosa				+		+ + +			+									+									
Oxalis obtusa											++						++++1+										

APPENDIX 2.—Phytosociological table for plant communities in the northern Cederberg. See Chapter 3 for cover abundance values and environmental codes (continued)

Community number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Heterogeneous relevés
Relevé number	111111 888888 123567	111 889 891	11 24549 04500	1111 11116893568 901237025904	1111111 3457777 8173456	56677789 38915936	4 4568	11 88888899999944 45678901345 24	233 612	1 554 028	11111111111111 33334440001111123577 37890171371236957278	5566 7823	111 233 912	111 22222233444544 5 24578945369456 4	1111 0066 2448	1111 44666 57269	11111111111 34001111122222 02890457801 23	111111111 11116777889233334577 12456896678129634693612	1 66 7845	1 775 243	11 22 78	1 990 785	11 556 190	11 767 359	11 67 70	111 556 083	111111111 12235670023455 68 37136610064091510
BI. Non-diagnostic species continued																											
Aspalathus ciliaris																											
Haemanthus sp.			+	+ +				o + o					1+					+									
Pelargonium spp.					+				o				+				+	+								o	
Salvia africana-caerulea				+					+				+	1				+		1			+				+ +
Acrosanthes humifusa					+ +			o						+													
Albuca sp.				+ o										+					1								
Arctotis laevis						o								+													
Caesia contorta																											
Crassula umbella			+	+			+												1		1						
Erica articularis																											
Erica senilis																											
Erica sp.																											
Helichrysum spp.																											
Leucadendron concavum																											
Leucadendron loranthifolium																											
Mesembryanthemaceae spp.																											
Oftia africana																											
Othonna amplexifolia																											
Pellaea pteroides																											
Pentaschistis thunbergii																											
Senecio sp.																											
Cuscuta nitida																											
Cyperaceae *sp.*																											
Eremia totta																											
Helichrysum asperum																											
Heliophila scoparia																											
Hypodiscus argenteus																											
Rafnia amplexicaulis																											
Sutera hispida																											
Syncarpha variegata																											
Ursinia sp.																											
Zygophyllum flexuosum																											
Thamnochortus acuminatus																											
Ursinia anthemoides																											
Aspalathus aristata																											
Brachycarpaea juncea																											
Euphorbia tuberosa																											
Euryops othonnoides																											
Campanulaceae sp. (11471)																											
Cissampelos capensis																											
Crassula pustulata																											
Felicia ferulacea																											
Helichrysum acrophilum																											
Helichrysum sp. (11812)																											
Hermannia alnifolia																											
Hermannia aspera																											
Hermannia scabra																											
Ifloga ambigua																											
Indigofera spp.																											
Lachnaea filamentosa																											
Lachenalia sp.																											
Mohria caffrorum																											
Orchidaceae spp.																											
Passerina vulgaris																											
Pentaschistis colorata																											
Prismatocarpus sp. (10859)																											
Protea magnifica																											
Protea repens																											
Stoebe sp.																											
Sutera sp.																											
Tetraria bolusii																											
Thesium oresigenum																											
Tritoniopsis sp.																											

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